Equitable Earth

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Contact:
Equitable Earth
info@eq-earth.com

Core Document

Methodology for Terrestrial Forest Restoration

Summary

This methodology sets out the criteria, requirements, and procedures for certifying terrestrial forest restoration projects. It includes the principles and methods for establishing baselines, demonstrating additionality, quantifying net GHG removals, as well as monitoring and reporting requirements.

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1 Introduction

1.1 Normative References

1.1.1 This document must be read in conjunction with the following documents:

- AGB Benchmark
- Equitable Earth Standard
- Programme Manual
- Protocol for Carbon Curve Modelling
- Protocol for Field Data Calibration
- Registry Procedures
- Standard Setting and Methodology Development Procedure
- Terms & Definitions

1.2 Reading Notes

1.2.1 This document is divided into *Principles* and *Methods*:

1.2.1.1 Principles set out the requirements applying to each of the three pillars.

1.2.1.2 Methods elaborate on how developers and Equitable Earth must apply these requirements.

1.3 Effective Dates

1.3.1 This version of the methodology becomes applicable on August 1, 2025. All Projects submitting their Feasibility Study Report on or after this date must conform to this version of the methodology.

1.3.1.1 Note that Equitable Earth will not process requests in relation to the requirements set out in Section 5.1.3 and the Protocol for Field Data Calibration until March 1, 2026.

1.3.2 Projects that submitted a Feasibility Study Report before the effective date may continue under the version applicable at the time of submission, unless developers choose to adopt the current version.

1.3.3 Equitable Earth reserves the right to request alignment with partial or all updated requirements if deemed necessary.

Part I - Criteria and Procedures for Developers

2 Eligibility Criteria

This section outlines the eligibility criteria and requirements for projects.

2.1 Scope

2.1.1 The scope of this methodology includes:

1) **Restoration of degraded lands:** projects aiming to restore forest cover on degraded lands using a variety of restoration techniques that combine both active and passive restoration strategies, allowing for flexible and context-specific approaches.[1]

2) **Promotion of secondary forest growth:** projects fostering the recovery of degraded forests through conservation efforts or assisted natural regeneration techniques.

2.2 Eligibility Criteria

2.2.1 Projects may be located on any type of degraded land.

2.2.2 Projects must restore degraded lands into terrestrial forest.

2.2.3 Projects must be restored to one of the following biomes according to the IUCN Global Ecosystem Typology: 'Tropical-subtropical forests' (T1), 'Temperate-boreal forests' (T2), 'Trophic savannas' (T4.1), 'Pyric tussock savannas' (T4.2), 'Hummock savannas' (T4.3) or 'Temperate woodlands' (T4.4).

💡 Future methodologies will cover other ecosystem categories.

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[1] Note that afforestation activities are not eligible under this version of the methodology.

2.2.4 Where projects have experienced significant anthropogenic degradation within ten years prior to the project start date, developers must provide evidence that such degradation did not occur with the intent to develop a project and benefit from additional carbon revenues.

2.2.5 Projects of any size are eligible to apply this methodology. No minimum or maximum land area or net GHG removal capacity is required.

2.3 Project Design

2.3.1 Projects must be designed to:

2.3.1.1 Restore previously degraded terrestrial forests by reestablishing ecosystem composition, structure, function, and adaptivity, in alignment with a defined reference ecosystem.

2.3.1.2 Increase available habitat capacity for native species.

2.3.1.3 Foster sustainable livelihoods by ensuring that project activities generate tangible benefits to IPs & LCs, ensuring their active participation and engagement throughout the project lifetime.

2.3.2 Projects must strive to increase ecological connectivity at the landscape level, where activities within the project's scope can remove or reduce barriers.

2.3.3 Whenever possible, developers should strive to protect the project area through a conservation easement or equivalent legal mechanism under a nationally and/or internationally recognised status to ensure legal, long-term conservation.

3 Ecological Condition

3.1 Principles

Reference Ecosystem

3.1.1 Projects must strive to restore previously degraded terrestrial forests by reestablishing ecosystem composition, structure, function, and adaptivity, in alignment with a defined reference ecosystem.

3.1.2 To support this, developers must identify a reference site that represents the ecological state the project is trying to achieve in the restoration site(s). This site must inform both the restoration design and the estimation of project net GHG removal capacity.

3.1.3 Developers must use multiple sources of information to select the reference site, including feedback from engagement with relevant stakeholders, archives, sites with different recovery levels, literature, and any other relevant sources.

3.1.4 The reference site must be physically accessible by the developer from the beginning of the feasibility phase through to the project registration date in order to:

1) Collect reference data to inform baseline calculations

2) Undergo assessment during validation, if deemed necessary by the VVB

3.1.5 The reference site must not have undergone significant anthropogenic disturbance in the ten years before the project start date.

3.1.6 The reference site should be at least 40 years old.

3.1.6.1 If the developer is unable to locate a site of this age within the region, a younger reference site may be selected, provided it meets the other attributes defined in this section. In such cases, developers must follow the project deviation procedures outlined in the Programme Manual.

3.1.7 The reference site must present the following six key attributes:[2]

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[2] The Reference Ecosystem guiding principles, including the six key attributes, the scoring systems, and the Recovery Wheel were drawn from Gann, G. D., et al. (2019). International Principles and Standards for the Practice of Ecological Restoration and adapted to Equitable Earth's needs by Equitable Earth.

1) **Absence of threats:** direct degradation drivers impacting the ecosystem's health, such as over-utilisation, contamination, and invasive species, are minimal or effectively absent.

2) **Physical conditions:** the properties required to sustain the ecosystem, such as soils, water, and topography, are present, and their physical and chemical conditions are appropriate.

3) **Species composition:** the array and relative proportions of organisms. Native species characteristic of the appropriate ecosystem are present, whereas invasive species are minimal or effectively absent.

4) **Structural diversity:** the physical organisation of living and non-living elements (e.g., forest layers and food webs). The appropriate diversity of key structural components, including demographic stages, faunal trophic levels, vegetation strata, and spatial diversity, are present.

5) **Ecosystem function:** when assessing the roles and processes arising from interactions among living and non-living elements, the appropriate levels of growth and productivity, nutrient cycling, decomposition, habitat, species interactions, and types and disturbance rates are present.

6) **External changes:** the flows between sites and the surrounding environments of the ecosystem are appropriately integrated and connected to allow for abiotic and biotic flows and exchanges.

3.1.8 These attributes must be used to characterise the reference site, evaluate baseline conditions at the reference site(s), and provide key indicators for the project's desired restoration outcomes.

3.1.9 If a reference site that meets the six attributes above cannot be found, the developer must select one that meets as many as is feasible, and describe and justify, with supporting evidence, why the remaining attributes cannot be met.

3.1.10 In cases where landscape-scale projects encompass multiple biomes and/or ecosystems, developers may select one reference site per group.

3.1.11 In cases where a different reference site was used for pre-submission activities compared to the new restoration site(s), developers must clearly specify and differentiate between the reference site(s) in the zonation.

Restoration Interventions

3.1.12 Developers must engage a trained professional with a background in ecology and natural resources management and, where relevant, someone holding traditional or local ecological knowledge of the ecosystem.

3.1.13 Developers should adopt practices that maximise ecological outcomes across the continuum of intervention types.

3.1.14 Developers must design and implement a mitigation plan to address existing threats to increase the success rate of restoration efforts.

3.1.15 Projects must not harvest timber for commercial purposes. Exceptions are made only for the required removal of remnants of a commercially-managed forest or exotic and invasive species that must be removed as part of site preparation activities.

3.1.16 Developers may apply thinning practices in the restoration site(s) throughout the project's lifetime.

3.1.17 Developers using thinning practices must design and implement a sustainable management plan. The plan must be detailed in the Project Design Document and must include:

1) The ecological rationale—demonstrating the necessity of thinning for restoration
2) The targeted species and restoration site(s)
3) The thinning practices to be used and their expected outcomes
4) The estimated percentage reduction in total biomass (including AGB and BGB) resulting from thinning activities, compared to the biomass levels recorded at the beginning of the current Adaptive Management cycle
5) Measures to mitigate potential environmental impacts, such as erosion or biodiversity loss
6) Plans for the utilisation or disposal of removed biomass (e.g., decomposed on-site, used for local sustainable projects, commercialised)

3.1.18 Equitable Earth reviews the sustainable management plan and may reject it if the provided information is inadequate or lacks sufficient detail.

3.1.19 Equitable Earth monitors changes in AGB within the area where thinning takes place and the timeframe outlined in the restoration plan, comparing these measurements to the baseline or reference levels set in the previous year's assessment.

3.1.19.1 If the monitored AGB reduction exceeds the threshold set in the restoration plan, the developer must provide a comprehensive justification for the discrepancy. This justification must be included in the following Annual Report, detailing the reasons for the variation and any actions taken to address or mitigate it.

3.1.19.2 If Equitable Earth determines that the justification is insufficient or inadequate, the event will be classified as a loss event and must follow the reversal procedures outlined in the *Compensation of Reversals* section of the Programme Manual.

Site Preparation

3.1.20 All site preparation techniques used as part of a project must be planned and implemented to minimise risks, adhere to safeguards, and mitigate negative socio-environmental impacts in line with the requirements in the Equitable Earth Standard and this methodology.

3.1.21 Developers implementing site preparation techniques must:

3.1.21.1 Describe the technique and justify its selection, including a detailed monitoring protocol, in the restoration plan.

3.1.21.2 Describe the scale (e.g., small or large) of the implementation, including the size of the intervention area and the frequency of intervention, with justification. Developers must apply the selected methods in a way that prevents any uncontrolled negative impacts or unintended spillover into adjacent areas.

3.1.21.3 Provide a clear delimitation of the areas in which the methods will be implemented.

3.1.21.4 Demonstrate that the site preparation techniques comply with local, regional, and/or national regulations, where applicable.

3.1.21.5 End site preparation activities when planting of target species or other regeneration activities begin, as defined in the restoration plan.

3.1.22 Projects utilising intensive site preparation techniques (e.g., involving the use of chemicals, transitory non-native species, mechanical intervention, and prescribed burning) must:

3.1.22.1 Meet the technique-specific requirements, set out in *Appendix C*, in addition to the requirements in this section.

3.1.22.2 Justify that the implementation of the project would not be feasible using non-invasive and non-detrimental methods. Valid justification may include, but is not limited to, inaccessibility of certain areas, financial limitations, and unavailability of alternative sustainable practices. Such justification must be substantiated with evidence and will be evaluated by Equitable Earth and the VVB on a case-by-case basis.

3.1.22.3 Identify the applicable carbon parameters that will be used to quantify GHG emissions associated with the implementation of the techniques, where applicable.

3.1.23 Under this version of the methodology, the removal of transitory species will be classified as a loss event and must follow the reversal procedures outlined in the *Compensation for Reversal* section of the Programme Manual.

Genetic Diversity

3.1.24 Projects must strive to retain and augment genetically diverse populations.

3.1.24.1 Projects must strive to select seeds and plant materials that are genetically diverse and generated within or in the vicinity of the project area to ensure the conservation of locally adapted traits.

3.1.24.2 Projects should source from a nursery which breeds endemic and endangered species.

3.1.24.3 Projects should maintain sufficient seed resources for reproduction, animal consumption, and provisioning for NTFPs, where applicable.

Species Diversity

3.1.25 Projects must include a mix of native species, favouring endemic and threatened ones when possible.

3.1.25.1 Projects must select species according to the diversity patterns of the restoration site(s).

3.1.25.2 Projects must consider succession dynamics and population dynamics.

3.1.25.3 Projects must strive to favour mutualistic interactions between species.

3.1.26 Projects must exclude the use of exotic species as part of the restoration plan.

3.1.26.1 Exceptions can be made for non-invasive species that are historically exotic or non-native but considered part of the ecosystem, or perform ecosystem functions that support long-term restoration efforts. In such cases, developers must provide peer-reviewed scientific literature corroborating its use.

3.1.26.2 Exceptions can be made for non-invasive exotic species that provide structural elements that favour restoration activities in the early stages of a project (e.g., fast-growing species that regenerate the soil or provide shade for other species). In this case, the exotic species must be removed within the first ten years of the crediting period.

3.1.27 Developers should have a plan to protect and/or reintroduce threatened, vulnerable, and endangered species of relevant functional groups that are endemic or native to the area.

3.1.28 If developers aim to actively reintroduce animal species, they should ensure the long-term viability of this approach, demonstrating the projected impact on the ecosystem's trophic system.

Threats and Drivers of Deforestation and Degradation

3.1.29 Developers must systematically identify threats and drivers of deforestation and degradation to define interventions that effectively address them, and support restoration and secondary forest growth.

3.1.30 Developers must identify and analyse primary ecosystem threats, including past degradation causes, current drivers (e.g., logging, agricultural expansion), and the agents involved (e.g., local farmers, logging operators).

3.1.31 Developers should leverage historical data, local expertise, and active engagement with relevant stakeholders, particularly IPs & LCs, to ensure an accurate, context-specific understanding of threats and drivers.

3.1.32 Developers must strive to remove degradation drivers affecting the project area, such as browsing, overgrazing, illegal or unsustainable harvesting or hunting practices, nutrients and chemical runoffs, and proliferation of invasive species. Developers should implement targeted activities to address the root causes of both unplanned and planned degradation, including:

3.1.32.1 **Exclusion of degrading practices:** prohibition of activities such as harvesting and logging within the project area to promote secondary forest growth, and implementation of controls to reduce access, where feasible.

3.1.32.2 **Community-based sustainable practices:** collaboration with communities to encourage sustainable resource use and alternative livelihoods.

3.1.33 Developers must strive to eliminate emergent and recurring barriers to regeneration and forest regrowth, such as, but not limited to, invasive species, grazing, uncontrolled fire, soil erosion, flooding, pests, disease, and smothering.

3.1.33.1 If invasive species and/or other aggressive woody and non-woody vegetation are present and interfere with natural forest recovery, developers must remove them to lay the ground for restoration. All site preparation techniques must conform to the requirements set out in the *Site Preparation* section and *Appendix C*, where applicable.

3.1.33.2 Developers must detail plans for the proper disposal of removed invasive floral species, focusing on minimising carbon emissions linked to their disposal.

💡 In this version of the methodology, Equitable Earth will not explicitly factor the emissions resulting from the removal of invasive species in carbon calculations.

Adaptation & Resilience

3.1.34 Developers must strive to select species considering the long-term context of a changing climate and its future effects on landscapes and ecosystems.

💡 Equitable Earth acknowledges that this practice is not trivial and recommends that developers look for science-based recommendations to support the selection of plant species and varieties.

Non-Timber Forest Products (NTFPs)

Planning

3.1.35 Before introducing NTFP species to the restoration plan, developers must:

3.1.35.1 Determine species according to *Species Diversity* requirements.

3.1.35.2 Consult relevant communities via community consultation to understand their traditional practices, the cultural and/or spiritual value attributed to NTFPs, and their subsistence reliance on them. Feedback must be integrated into NTFP planning.

3.1.35.3 Demonstrate the balanced introduction of NTFP species, ensuring that they do not excessively compete with other species for resources. The developer must propose and justify the proportion of NTFP species within the overall species composition based on site-specific ecological conditions. The justification must be supported by relevant peer-reviewed literature, ecological data, or other credible sources demonstrating alignment with the characteristics of the reference site.

Harvesting Protocols

3.1.36 Developers must design species-specific harvesting protocols that ensure the sustainable collection of NTFPs. The protocols must include:

1) The delimitation of collection sites in the project area where harvesting can occur

2) Safeguards to ensure that the NTFP regeneration rate surpasses its extraction rate

3) The frequency, quantity, and parts of the plant that can be harvested

Capacity Building and Training

3.1.37 Developers should organise regular training sessions for IPs & LCs on the sustainable harvesting protocols and the ecological role of NTFPs.

3.1.38 Developers should promote local ownership by involving IPs & LCs in monitoring the use of NTFPs and participating in data collection processes.

3.1.39 Developers should encourage IPs & LCs to report any unethical or illegal harvesting activities.

Adaptive Management

3.1.40 Developers must review the NTFP protocol every four years to account for changes in the ecosystem, IP & LC needs, the latest science, and global best practices.

Equity and Fair Benefit Sharing

3.1.41 Developers must ensure that access to NTFPs and their derived benefits is fair and equitable. Particular attention should be paid to vulnerable stakeholders and IPs & LCs who depend on these resources for their livelihoods.

3.2 Methods

Reference Ecosystem

3.2.1 Developers must select the reference site and submit a shapefile to Equitable Earth for review.

3.2.2 If the project has multiple biomes or ecosystem types, developers may select one reference site for each and indicate the link between restoration sites and corresponding reference sites in the project zonation.

3.2.3 Equitable Earth assesses whether the reference site meets the required ecological attributes, age, and absence of disturbance. Equitable Earth may request additional evidence if the justification is deemed insufficient.

Field Assessment

3.2.4 Developers must complete a field assessment at the reference site and the restoration site(s). This includes assessments of pre-submission activity groups, where applicable.

3.2.5 Equitable Earth assigns developers random plots for the assessment of each restoration site indicated during the zonation. Refer to *Appendix D* for more details on the random plot procedure.

3.2.5.1 For each plot, developers must analyse all the attributes used to identify the reference site(s). Refer to the *Reference Ecosystem* section for more details.

Baseline Assessment

3.2.6 Developers must conduct a comprehensive baseline assessment to inform the design of restoration interventions. This includes the:

1) Project zonation
2) Field assessment. Please refer to the *Field Assessment* section for more details.
3) Restoration plan. Please refer to the *Restoration Plan* section for more details.
4) Community consultation, where applicable, to integrate insights and priorities from IPs & LCs and relevant communities into the assessment

Restoration Plan

3.2.7 Developers must design a restoration plan based on a clear understanding of the ecological conditions in the project area.

3.2.8 The restoration plan must include the following elements:

3.2.8.1 **Summary:** an overview, including the target ecosystem(s), main ecological objectives, proposed interventions, and anticipated outcomes.

3.2.8.2 **Objectives:** clear and measurable ecological and biodiversity objectives that the project aims to achieve. Where appropriate, objectives should align with relevant SDG indicators.

3.2.8.3 **Interventions:** detailed descriptions of the restoration practices to be implemented. Each intervention must:

1) Be justified with a clear rationale, based on the ecological context and restoration goals.
2) Include expected ecological outcomes.
3) Be paired with specific indicators to track progress.
4) Specify the monitoring frequency for each indicator.

3.2.9 During the first four years of each plantation cycle, developers must include seedling survival rates as an indicator for plantation-related interventions.

Measurement and Reporting

3.2.10 Refer to the *MRV Procedures* section for more details.

4 Carbon

4.1 Principles

Additionality

4.1.1 Developers must demonstrate additionality using a project method, following the steps below.

4.1.1.1 **Regulatory surplus.** Developers must demonstrate that there is no enforced legal obligation to restore the restoration site(s).

4.1.1.2 **Barrier analysis.** Developers must identify existing barriers that would prevent the project activities from taking place without the revenues from VRUs. Barriers may include one or more of the following:

4.1.1.2.1 **Financial barriers:** challenges related to insufficient funding, high upfront costs, difficulty accessing finance, and the lack of a clear monetary value for standing forests and sustainable forest products. This includes existing policies and requirements other than legal obligations to lower GHG emissions (e.g., non-mandatory policy incentives and enablers).

4.1.1.2.2 **Technical barriers:** challenges related to the application of technology, methodologies and technical expertise. Barriers may include difficulties in applying established methodologies, managing complex technical tasks, and ensuring accurate measurement and monitoring of key outcomes such as carbon sequestration.

4.1.1.2.3 **Capacity barriers:** challenges related to education, technical training, and human resources. Barriers may include a lack of skilled personnel or insufficient training in restoration techniques, monitoring protocols, and carbon accounting.

4.1.1.2.4 **Logistical barriers:** challenges related to the infrastructure, operational aspects of a project, and labour shortages. Barriers can include poor accessibility to key sites, limited transportation options, inadequate facilities, and the unavailability of necessary materials.

4.1.1.2.5 **Cultural and social barriers:** challenges in the collective movement of communities towards implementing, maintaining and monitoring restoration projects due to, for example, lack of information, threats to the safety of community members, and existing social structures and norms.

4.1.1.2.6 **Regulatory and institutional barriers:** limitations within the regulatory framework and its relevant institutions, such as limited staff capacity, lack of necessary skills, local regulations, complex permitting processes, ineffective bureaucratic processes or challenges in meeting specific compliance standards.

4.1.1.3 **Common practice assessment.** Developers must demonstrate that activities similar to the project activity are not common practice in the project's jurisdiction, following the steps set out in the *Methods* section below.

Permanence

Safeguards

4.1.2 Developers must ensure the permanence of carbon sequestration by developing ecosystem-specific safeguards to avoid reversals.

4.1.3 Developers must mitigate the risk of unintended fires by preparing a fire prevention and management strategy for the project area. This strategy must include a risk assessment and corresponding mitigation actions (e.g., training, dedicated infrastructure, how equipment will be provided, how synthetic fuel will be removed, etc.) to be implemented.

4.1.4 Developers must demonstrate that projects can secure access to irrigation needs and will not increase pressure on water resources by identifying:

1) Infrastructure for water access in the project area

2) Any potential tensions regarding access to water resources around the project area

4.1.5 Developers must assess whether dangerous activities occur in the neighbouring areas of the project and implement safeguards to prevent negative impacts on the project area, if applicable.

4.1.5.1 Dangerous activities include, but are not limited to, chemical processing/treatment, non-organic industrial agriculture or animal farming, waste treatment facilities, and any other activity generating classified dangerous residues.

Reversals

4.1.6 All reversal risks must be assessed, monitored, and mitigated.

4.1.6.1 Refer to the *Compensation of Reversals* section in the Programme Manual for more details.

💡 Corporate buyers are encouraged to use an Emissions Liability Management[3] approach to carbon accounting. Corporate buyers are encouraged to replace any cancelled credits to ensure the validity of their claims.

Leakage

4.1.7 Projects must assess leakage risks, implement mitigation measures, monitor displacement effects, and quantify leakage emissions as part of net GHG removal calculations.

4.1.8 Projects must address both activity-shifting leakage and market leakage.[4]

4.1.9 Projects must strive to limit activity-shifting leakage, including wood collection (e.g., for firewood, charcoal), timber harvesting, agriculture (e.g. grazing or cultivation), and human settlement.

4.1.10 Market leakage is accounted for via the dynamic baseline because VRUs are only issued for net GHG removals that surpass the dynamic baseline. As the vast majority of displaced activities resulting from this methodology tend to lead to localised impacts near the project boundary, market leakage is considered *de minimis*.[5] This net GHG quantification approach ensures an exclusive focus on forest recovery, with VRUs reflecting only measurable forest regrowth from the current degraded condition, without claiming avoided emissions from halted deforestation.[6]

4.1.10.1 Equitable Earth may assess, on a case-by-case basis, whether the project context presents a substantial risk of market leakage. Where necessary, additional adjustments may be required to ensure conservativeness.

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[3] Marc Roston, Alicia Seiger, Thomas Heller, 2023. What's next after carbon accounting? Emissions liability management. [online] Oxford Open Climate Change, Volume 3, Issue 1. Available at: URL

[4] See definitions in Terms & Definitions

[5] Murray, B. C., McCarl, B. A., & Lee, H.-C. (2004). Estimating leakage from forest carbon sequestration programs. Land Economics, 80(1), 109–124.

[6] Aukland, L., Costa, P. M., & Brown, S. (2003). A conceptual framework and its application for addressing leakage: The case of avoided deforestation. Climate Policy, 3(2), 123–136.

4.2 Methods

Additionality

4.2.1 Both Equitable Earth and the VVB will assess the demonstration of additionality and all supporting evidence provided.

4.2.2 Developers must demonstrate additionality following the steps set out below.

Regulatory Surplus

4.2.3 Developers must identify all relevant local, regional, or national legislation, policies, or agreements in force in the project's jurisdiction.

4.2.3.1 For high-income countries,[7] all legal requirements should be deemed enforceable.

4.2.3.2 For countries other than high-income countries, legal requirements should only be deemed non-enforceable based on legal and verifiable sources relevant to the mitigation activity.

4.2.3.3 Where a legal obligation to undertake restoration or conservation work applies to the project area but not to the restoration site(s), developers must indicate and prove exactly where it applies.

4.2.3.4 Where a legal obligation to restore applies to the restoration site(s) but cannot be fulfilled without the Project's funds or technology, the developer must prove that said barriers exist to establish additionality.

Barrier Analysis

4.2.4 Developers must demonstrate the presence of existing barriers to the implementation of project activities and provide supporting evidence for assessment by Equitable Earth and the VVB. Evidence may include, but is not limited to, the barriers outlined below.

4.2.4.1 **Financial barriers:** statements of account, notice of refusal of subsidies, and evidence that alternative land uses are more profitable without carbon credits.

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[7] Refer to the Terms & Definitions document for a full list of high-income countries.

4.2.4.2 **Technical barriers:** lack of tools, records of failed pilot trials, and limited availability of species adapted to local conditions.

4.2.4.3 **Capacity barriers:** list of staff, job descriptions, expertise & relevant knowledge, access to training and capacity-building resources, training records (or lack thereof).

4.2.4.4 **Logistical barriers:** maps showing remoteness or poor access, transport cost estimates or invoices, and photos of terrain and access routes.

4.2.4.5 **Cultural and social barriers:** stakeholder engagement reports, evidence of past opposition or failed restoration attempts, and records of traditional land use patterns.

4.2.4.6 **Regulatory and institutional barriers:** unclear or restrictive legal frameworks for land use or carbon rights, evidence of policy gaps or lack of institutional support, land tenure records or land registry status, legal reviews of land or forestry laws, and correspondence with authorities showing regulatory delays.

Common Practice Assessment

4.2.5 Developers must demonstrate that the project activity would not be common practice using the following steps:

4.2.5.1 Define the project activity (i.e., type(s) of restoration interventions).

4.2.5.2 Define the geographic region for the assessment. The geographic region should have a similar policy environment as the project area, and should, at most, align with the national jurisdiction. Where there are sub-national (e.g., regional, local) programs providing incentives for restoration activities, then the geographic region for assessment should align with them.

4.2.5.3 Identify any activities similar to the project activity that have been implemented previously or are currently underway in the defined geographic region, excluding any activities that are under certification or registered with Equitable Earth. Similar activities are those with comparable practices (e.g., type(s) of restoration interventions).

4.2.5.4 Compare the project activity to any identified similar activities, describing any distinctions between the project activity and similar activities.

4.2.6 If there are no distinctions between the similar activities and the project activity, then the project is not additional.

4.2.7 If there are clear distinctions, then the project is not common practice and therefore additional. Clear distinctions include identifiable changes in circumstances under which the project activity will be implemented (e.g., barriers exist, promotional policies or financing have ended, or similar activities were more financially attractive via subsidies or other financial flows).

4.2.8 Instead of the steps above, the developer may also provide recent (i.e., within five years of the project start date) government data on restoration activities in the defined geographic region to demonstrate that the activity is not common practice.

Permanence

Risk Assessment

4.2.9 Equitable Earth identifies delivery and reversal risks and assesses their likelihood and the severity of their consequences. Refer to the *Risk Assessment* section of the Programme Manual for more details.

Loss Events

4.2.10 Loss events must be monitored, reported, quantified, and compensated.

4.2.10.1 **Detection**. If developers or Equitable Earth identify a loss event inside the project area that results in a cumulative carbon stock reduction exceeding 5% of previously verified net GHG removals in pools accounted for within the project boundary, they must notify one another within 30 calendar days.

4.2.10.1.1 Developers must report on loss events during the project lifetime. Refer to the *Reporting* section of the Equitable Earth Standard for more details.

4.2.10.2 **Quantification & Accounting.** Equitable Earth quantifies the impact of loss events before each verification. Refer to the *Quantification of Loss Events* section for more details.

Reversals

4.2.11 If reversals occur during the project lifetime, VRUs must be compensated through the buffer pool mechanism. Refer to the *Compensation of Reversals* section in the Programme Manual for more details.

Leakage

Activity Displacement Mapping

4.2.12 **Stakeholder Engagement.** Developers must adequately engage with relevant stakeholders to identify land-use activities that will be displaced due to project interventions.

4.2.13 **Zonation.** Developers must define the displaced activity areas. The displacement magnitude is determined by:

4.2.13.1 Informing the precise location and size of the hosting area; OR

4.2.13.2 Informing the percentage of the activity that will be displaced during the crediting period

4.2.14 **Activity Displacement.** Developers must provide details regarding the activity displacement, including the justification of the percentage of displacement.

4.2.15 **Mitigation Plan.** Developers must establish a mitigation plan to minimise the scale and impact of activity-shifting leakage. The mitigation plan must include:

1) planned mitigation interventions

2) stakeholders involved

3) corresponding timeline

4.2.16 These interventions must be detailed in the Project Design Document and reported on annually.

4.2.17 **Initial Leakage Estimation.** Refer to the *Initial Leakage Quantification* section for more details.

4.2.18 **Leakage Quantification.** The initial leakage estimation may be corrected before each verification as outlined below.

4.2.19 Developers must revise the information on the displaced activities by:

1) updating the project's zonation

2) providing details, where available, regarding the reinstatement of the activity

4.2.20 Equitable Earth recalculates leakage using the updated information submitted by the developer. Please refer to the *Leakage Quantification* section for more details.

Monitoring

4.2.21 Equitable Earth monitors the following:

1) the leakage belt, annually

2) the hosting area(s) and the displaced activity area(s) prior to each verification

4.2.22 Equitable Earth reports monitored leakage emissions at each verification.

4.2.23 Equitable Earth must notify developers of land cover changes in the leakage belt that exceed the average observed over the past five years.

4.2.23.1 Developers must justify whether the change is linked to the project activities or not.

4.2.23.2 If the justification is deemed unsatisfactory, Equitable Earth reserves the right to take additional measures, as appropriate, to assess the cause of land cover changes.

Measurement and Reporting

4.2.24 Refer to the *MRV Procedures* section for more details.

5 MRV Procedures

💡 This section applies the Equitable Earth Programme's MRV (Monitoring, Reporting, and Verification) requirements to M001.

5.1 Indicators & Parameters

Parameters for Equitable Earth

5.1.1 Equitable Earth must define, at a minimum, the following carbon parameters, including but not limited to the following:

1) reference site(s) area
2) restoration site(s) area
3) above-ground biomass (AGB) density
4) root-to-shoot (RS) ratios
5) carbon fraction of dry biomass
6) forest cover used for permanence and leakage monitoring
7) leakage parameters (i.e., hosting area and percentage of displacement)
8) standard error from the AGB provider for each pixel
9) correlation factor between the pixels

Project parameters

5.1.2 Developers must establish indicators on:

5.1.2.1 Ecological condition interventions

5.1.2.2 Social additionality interventions

5.1.2.2.1 If the project includes NTFP-related activities, developers must include the performance of harvesting protocol(s) as an indicator in the Social Additionality Plan.

5.1.2.3 Identified reversal and delivery risks

5.1.2.4 Implemented mitigation actions related to safeguards

Field Calibration

5.1.3 Developers may calibrate any carbon stock calculations using field data collection methods.

5.1.3.1 To calibrate carbon potential accounting, developers must submit a calibration request to Equitable Earth no later than 30 calendar days after receiving the GHG Parameters and Baseline Calculation Report.

5.1.3.2 To calibrate VRU accounting, developers must submit a calibration request no later than 60 calendar days before the publication of the GHG Monitoring Report.

5.1.3.3 Requests submitted outside of these deadlines may not be accepted if they risk delaying the certification process.

5.1.3.4 Refer to the Protocol for Field Data Calibration for more details on the field calibration procedure.

5.2 Monitoring

Monitoring Applicable to Equitable Earth

5.2.1 Prior to each verification, Equitable Earth quantifies the net GHG removals of the project using the specified carbon parameters. Refer to *Part II - Criteria and Procedures for Equitable Earth* for more details.

5.2.2 Equitable Earth monitors loss events as described in the Equitable Earth Standard and leakage as described in the *Leakage* section.

Monitoring Applicable to the Project

5.2.3 Developers must monitor all indicators defined during the certification process.

5.2.4 In addition, developers must monitor:

1) Any project deviations

2) The realised expenses from the last verification period, including benefit-sharing-related payments and details

5.3 Reporting

Reporting Applicable to Equitable Earth

5.3.1 Using the parameters of the *Indicators & Parameters* section, Equitable Earth compiles a GHG Monitoring Report that consolidates the results of the net GHG removals achieved during the verification period. Refer to the *MRV* section of the Equitable Earth Standard for more details.

Reporting Applicable to the Project

5.3.2 Developers must complete the Annual Report, reporting on indicators for each pillar and consolidating the activities undertaken over the last 12 months.

Adaptive Management

5.3.3 Developers must update the Project Design Document every four years starting at the registration date, based on the updated assessments of the project compiled in every Annual Report. More specifically, developers must:

5.3.3.1 Perform a thorough field assessment to reassess all attributes and update the Project Design Document based on the findings.

5.3.3.2 Consult relevant communities to reassess needs, aspirations, and concerns, and update both the livelihoods interventions and the leakage mitigation objectives based on the findings. If discrepancies from the initial objectives arise, an agreement must be established between the developer and the communities.

5.3.3.3 Update the project budget for the next four years.

5.3.4 Upon receiving the updated documentation, Equitable Earth publishes the updated documentation on the Equitable Earth Registry. Refer to the Registry Procedures for more details.

Part II - Criteria and Procedures for Equitable Earth

6 Introduction

6.1 Project Boundary

6.1.1 The project boundaries delimit all carbon pools, emission sinks, and emission sources considered in this methodology. The project boundary must include the:

1) restoration site
2) reference site
3) leakage belt

6.2 Emission Sinks & Sources

List of Relevant GHG Sinks

6.2.1 Relevant carbon pools included as emission sinks in this methodology are listed below. Carbon pools are considered emission sinks if they absorb GHGs from the atmosphere as a result of project activities.

Carbon Pool	Type	Inclusion	Justification
Woody biomass	**Above-ground**	Yes	Significant carbon pool
	Below-ground	Yes	Significant carbon pool
Non-woody biomass	**Above-ground**	Yes	Significant carbon pool

	Below-ground	Yes	Significant carbon pool
Soil organic carbon (SOC)		No	Measurement uncertainties, conservative to exclude
Soil inorganic carbon (SIC)		No	Measurement uncertainties, conservative to exclude
Dead wood		No	Conservative to exclude
Litter		No	Conservative to exclude
Harvested wood products		No	Conservative to exclude

List of Relevant GHG Sources

6.2.2 Relevant carbon pools included as emission sources in this methodology are listed below. Carbon pools are considered emission sources in the event of reversals, leakage, or relevant intensive site preparation techniques.

Carbon Pools	Type	Leakage	Reversal	Site Preparation	Justification
Woody biomass	**Above-ground**	Yes	Yes	Yes	Significant carbon pool
	Below-ground	Yes	Yes	Yes	Significant carbon pool
Non-woody biomass	**Above-ground**	Yes	Yes	Yes	Significant carbon pool
	Below-ground	Yes	Yes	Yes	Significant carbon pool
Soil organic carbon (SOC)		No	No	No	Measurement uncertainties & not relevant to M001 (soil inversion >25 cm not allowed)
Soil inorganic carbon (SIC)		No	No	No	Measurement

				uncertainties
Dead wood	No	N/A	No	Measurement uncertainties
Litter	No	N/A	No	Measurement uncertainties
Harvested wood products	No	N/A	N/A	Not relevant to M001 (commercial harvesting not allowed)
Burning of biomass	No	N/A	Yes	Carbon pool accounted for specific intensive site preparation techniques. Refer to the *Site Preparation Emissions Quantification* section for more details.
Emissions from nitrogen fertilisers	No	N/A	Yes	Carbon pool accounted for specific intensive site preparation techniques. Refer to the *Site Preparation Emissions Quantification* section for more details.
Burning of fossil fuels	No	N/A	No	*De minimis*

6.3 Monte Carlo Simulation

6.3.1 Equitable Earth uses a Monte Carlo simulation to aggregate pixel-level carbon estimates and uncertainty to project-level net GHG removal estimation and quantification. This method propagates uncertainties from each component and reflects their interactions accurately, providing a robust and comprehensive probabilistic representation of carbon sequestration and its corresponding uncertainty.

6.3.2 The Monte Carlo approach used by Equitable Earth involves sampling AGB values at the pixel level from a log-normal probability density function. These sampled values are then aggregated to calculate the overall AGB for the designated plot.

Methods

6.3.3 Through iterative sampling, the method constructs a comprehensive probability density function, capturing site-level uncertainty with precision. The key steps are outlined below.

6.3.4 For each pixel, the AGB estimate generated by the AGB provider is adjusted based on its associated uncertainty, following the procedure below.

6.3.4.1 The log-space mean μ_{log} and standard deviation σ_{log} are derived from the pixel's AGB estimate and standard error $\mathbf{SE}_{pixel}$.

6.3.4.2 Spatial correlation is incorporated by introducing a perturbation field, bounded between 0 and 1, and defined by equation (1):

$$\mathbf{Z}_{total,\,i} = \mathbf{Z}_{global,\,i} \times \sqrt{\varrho} + \mathbf{Z}_{noise,\,i} \times \sqrt{1 - \varrho} \quad (1)$$

Where:

- $\mathbf{Z}_{total,\,i}$ = Perturbation field across the studied area at iteration i; dimensionless
- $\mathbf{Z}_{global,\,i}$ = Global shock across the studied area at iteration i, identical for all pixels and randomly drawn in $[0, 1]$; dimensionless
- $\mathbf{Z}_{noise,\,i}$ = Pixel-level independent noise at iteration i, independently drawn for each pixel in $[0, 1]$; dimensionless
- ϱ = Correlation factor between the pixels, fixed at 0.01 as determined by the AGB provider; dimensionless

6.3.4.2.1 The perturbation field created is used to compute the pixel-level AGB value at iteration *i*, using equation (2):

$$\mathbf{AGB}_{mc,\,i} = exp(\mu_{log} + \sigma_{log} \times \mathbf{Z}_{total,\,i}) \quad (2)$$

Where:

- $\mathbf{AGB}_{mc,i}$ = Perturbated above-ground biomass across the studied area at iteration i; tDM
- μ_{log} = Mean of the log-normal distribution; dimensionless
- σ_{log}= Standard deviation of the log-normal distribution; dimensionless
- $\mathbf{Z}_{total,i}$= Perturbation field across the studied area at iteration i; dimensionless

6.3.4.3 AGB values are expanded to include BGB estimates. Both AGB and BGB are converted into their CO_2 equivalent (CO_2e) values.

6.3.4.4 The determined pixel-level GHG removals obtained are aggregated to estimate the total GHG removals for the plot in the specific iteration.

6.3.4.5 These steps are iterated to build a comprehensive probability distribution of net GHG removal at the plot level. During the iterations, the mean net GHG removal estimate stabilises as the simulation progresses. A minimum of 500 iterations must be performed to ensure robust and reliable results. More iterations may be conducted based on empirical observations.

6.3.4.6 The resulting distribution represents the range of potential net GHG removal values.

6.3.5 The Monte Carlo simulation is used at multiple stages of this methodology, including:

1) Estimation of carbon stock in reference site(s)
2) Estimation of carbon stock in restoration site(s)
3) Estimation of carbon stock losses in hosting area(s) and the leakage belt
4) Quantification of carbon stock losses for reversal assessment

7 Carbon Stock and Baseline Estimation

7.1 Baseline Carbon Stock

7.1.1 The project's baseline carbon stock is determined by the carbon stock $\mathbf{C}_{rest,0}$ and is expressed in tonnes of CO_2e.

Biomass Quantification of the Restoration Site

7.1.2 **Above-Ground Biomass (AGB)**. The AGB provider generates an AGB map that estimates the AGB at the pixel level in raster format for the restoration site(s). Equitable Earth then applies a Monte Carlo approach to this map to generate a distribution of possible AGB values. These values are referenced collectively as $\mathbf{AGB}_{rest,0}$ and are used as inputs in the iterative procedure described below. Refer to the *Monte Carlo Simulation* section for more details. If requested by the developer, the AGB value provided may be calibrated using field data. This calibration must conform to the requirements set out in the Protocol for Field Data Calibration.

7.1.3 **Below-Ground Biomass (BGB).** The BGB is estimated to be a proportion of its AGB. The relationship between BGB and AGB is represented by equation (3):

$$\mathbf{BGB}_{rest,0} = \mathbf{AGB}_{rest,0} \times \mathbf{RS} \qquad (3)$$

Where:

- $\mathbf{BGB}_{rest,0}$ = BGB of the restoration site at baseline; tDM
- $\mathbf{AGB}_{rest,0}$ = AGB of the restoration site at baseline; tDM
- $\mathbf{RS}$ = Root-to-shoot ratio of biomass; dimensionless

7.1.4 **Total Biomass of the Restoration Site.** The aggregated biomass comprises the above and below-ground biomass within the restoration site(s), and is obtained using equation (4):

$$\mathbf{B}_{rest,0} = \mathbf{AGB}_{rest,0} + \mathbf{BGB}_{rest,0} \quad (4)$$

Where:

- $\mathbf{B}_{rest,0}$ = Total biomass of the restoration site at baseline; tDM
- $\mathbf{AGB}_{rest,0}$ = AGB of the restoration site at baseline; tDM
- $\mathbf{BGB}_{rest,0}$ = BGB of the restoration site at baseline; tDM

Biomass Conversion to CO_2 Equivalents

7.1.5 Biomass in the restoration site(s) is converted into CO_2e to determine its total GHG removals.

7.1.6 Equitable Earth applies the AR-TOOL14 A/R Methodological tool's equations[8] to translate biomass into carbon content and subsequently into CO_2e. This ensures a consistent and standardised measurement aligned with global carbon reporting metrics.

7.1.7 The relation between carbon stock and tree biomass is obtained using equation (5).

$$\mathbf{C}_{rest,0} = \frac{44}{12} \times \mathbf{CF} \times \mathbf{B}_{rest,0} \quad (5)$$

Where:

- $\mathbf{C}_{rest,0}$= Carbon stock of the restoration site at baseline; tCO_2e
- $\frac{44}{12}$= Molecular weight ratio of CO_2 to carbon; dimensionless
- **CF** = Carbon fraction of tree biomass; tC/tDM. A default value of 0.47 is adopted[9].
- $\mathbf{B}_{rest,0}$ = Total biomass of the restoration site at baseline; tDM

[8] UNFCCC. (2013). 'AR-TOOL14 A/R Methodological tool: Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities Version 04.1'. Available at: URL (Accessed 25/01/2023)

[9] Eggleston, H S, Buendia, L, Miwa, K, Ngara, T, and Tanabe, K. (2006) 'IPCC Guidelines for National Greenhouse Gas Inventories. Japan.' Volume 4, Chapter 4 , Table 4.3, p 4.48. Available at: URL (Accessed 03/11/2023).

7.2 Reference Site Carbon Stock

This step estimates the carbon stock of the reference site.

Selection of a Reference Site

7.2.1 Equitable Earth requests the selection and adoption of a reference ecosystem and the geographical coordinates of a physical reference site from the developer.

7.2.2 Equitable Earth uses the reference site to quantify the GHG removal capacity of the project.

Assessment of the Reference Site

7.2.3 Upon receipt of the reference site shapefile, Equitable Earth assesses its characteristics (species, biome, age, etc.) following the guidelines established in the *Ecological Condition* section above.

7.2.4 If the reference site meets all required characteristics, Equitable Earth determines the carbon stock following the methods outlined in the *Carbon Stock at Reference Site* section below.

7.2.5 If the reference site meets all ecological criteria but is younger than 40 years, Equitable Earth assesses the situation and determines an alternative method on a case-by-case basis. Alternative datasets (e.g., the Harvard dataset[10]) may be used to ensure accurate estimation of the carbon stock value.

Carbon Stock at Reference Site

7.2.6 Using the reference site shapefile submitted, Equitable Earth generates an AGB map via its AGB provider to estimate the AGB at the pixel level within the reference site, in a raster format.

7.2.7 The AGB value of the reference site, referred to as $\mathbf{AGB}_{ref}$, is calculated using the AGB map provided through a Monte Carlo approach. Refer to the *Monte Carlo Simulation* section for more details.

[10] Walker, W., Gorelik, S., Baccini, A., Farina, M., Solvik, K., Cook-Patton, S., Ellis, P., Sanderman, J., Houghton, R., Leavitt, S., Schwalm, C., & Griscom, B. (2022). Global Potential Carbon (Version V6) [dataset]. Harvard Dataverse. https://doi.org/doi:10.7910/DVN/DSDDQK

7.2.7.1 At the developer's request, Equitable Earth may calibrate the AGB value using field data. This calibration must conform to the requirements set out in the Protocol for Field Data Calibration.

7.2.8 The associated BGB is obtained, using equation (6):

$$\mathbf{BGB}_{ref} = \mathbf{AGB}_{ref} \times \mathbf{RS} \tag{6}$$

Where:

- $\mathbf{BGB}_{ref}$ = BGB of the reference site; tDM
- $\mathbf{AGB}_{ref}$ = AGB of the reference site; tDM
- **RS** = Root-to-shoot ratio; dimensionless

7.2.9 The total biomass of the reference site is obtained using equation (7):

$$\mathbf{B}_{ref} = \mathbf{AGB}_{ref} + \mathbf{BGB}_{ref} \tag{7}$$

Where:

- $\mathbf{B}_{ref}$ = Total biomass of the reference site; tDM
- $\mathbf{AGB}_{ref}$ = AGB of the reference site; tDM
- $\mathbf{BGB}_{ref}$ = BGB of the reference site; tDM

7.2.10 The conversion to CO_2e is obtained using equation (8):

$$\mathbf{C}_{ref} = \frac{44}{12} \times \mathbf{CF} \times \mathbf{B}_{ref} \tag{8}$$

Where:

- $\mathbf{C}_{ref}$ = Carbon stock of the reference site; tCO_2e
- $\frac{44}{12}$ = Molecular weight ratio of CO_2 to carbon; dimensionless
- **CF** = Carbon fraction of tree biomass; tC/tDM. A default value of 0.47 is used.

- $\mathbf{B}_{ref}$ = Total biomass of the reference site; tDM

7.2.11 Equitable Earth calculates the average carbon stock in the reference site as an estimate of the carbon stock by size (in hectares). This process enables the utilisation of this data for further processing in the calculation of the project's GHG removal capacity. The average carbon stock per hectare in the reference site is obtained using equation (9):

$$\overline{\mathbf{C}_{ref}} = \frac{\mathbf{C}_{ref}}{\mathbf{A}_{ref}} \quad (9)$$

Where:

- $\overline{\mathbf{C}_{ref}}$ = Mean carbon stock of the reference site; tCO_2e/ha
- $\mathbf{C}_{ref}$ = Carbon stock of the reference site; tCO_2e
- $\mathbf{A}_{ref}$ = Size of the reference site; ha

7.3 Adjustment Factors

Initial Leakage Quantification

This section outlines the approach used to quantify leakage as part of the overall estimation of the project carbon potential. During project design, the developer may declare potential leakage through the following methods set out in this section.

Hosting Areas

7.3.1 If the developer knows where leakage will occur and is therefore able to provide the hosting area(s), Equitable Earth estimates the corresponding leakage using the same calculation process as for the restoration site(s). Equitable Earth conservatively assumes that leakage in the hosting area, referred to as $\mathbf{L}_i^{ha}$, is set equal to the carbon stock present in the area at baseline (i.e., it is assumed that all carbon stock originally in the hosting area will be lost).

Displaced Activity Areas

7.3.2 If the developer cannot provide the hosting area(s), they must identify the displaced activity area(s) within the project area. It is assumed that activities within this area will be displaced outside of the project area. The developer must provide an estimate of the percentage of the activities that will be displaced and result in leakage. This percentage should reflect changes in land use practices, including, but not limited to, the introduction of more efficient processes or elimination of activities due to retirement or job changes.[11]

7.3.2.1 To estimate the potential impact of the displacement(s), Equitable Earth estimates the conservative per-hectare carbon stock of the leakage belt by identifying the upper 5th percentile of the carbon stock distribution across all pixels within the leakage belt, as detailed in equation (10):

$$\mathbf{C}_{max-lb,0} = \mathbf{P}_{95}(\mathbf{C}_{lb-pixel,0}) \quad (10)$$

Where:

- $\mathbf{C}_{max-lb,0}$ = Conservative estimate of the leakage belt per-hectare carbon stock at baseline; tCO2e/ha
- $\mathbf{P}_{95}$ = indicates the 95th percentile, which corresponds to the upper 90% of the distribution
- $\mathbf{C}_{lb-pixel,0}$ = Distribution of pixel-level per-hectare carbon stock in the leakage belt at baseline; tCO2e/ha

7.3.2.2 The estimated leakage is obtained using equation (11):

$$\mathbf{L}_i^{da} = \mathbf{A}_i^{da} \times \mathbf{C}_{max-lb,0} \times \mathbf{P}_i \quad (11)$$

Where:

- $\mathbf{L}_i^{da}$ = Estimated leakage of the displaced activity area i at baseline; tCO_2e
- $\mathbf{A}_i^{da}$ = Size of the displaced activity area i; ha

[11] Pi = 1 indicates no improvements in practices, and Pi = 0.5 indicates the displaced activity is 50% less intensive as a result of practice improvements.

- $\mathbf{C}_{max-lb,0}$ = Conservative estimate of the leakage belt per-hectare carbon stock at baseline; tCO_2e/ha
- $\mathbf{P}_i$ = Declared % of activity displacement in the displaced activity area i at baseline; dimensionless

Total leakage

7.3.3 Total leakage is obtained by aggregating leakage derived from the hosting area(s) and displaced activity area(s), using equation (12):

$$\mathbf{L} = \sum_{i=1}^{n} \mathbf{L}_i^{ha} + \sum_{i=1}^{m} \mathbf{L}_i^{da} \tag{12}$$

Where:

- $\mathbf{L}$ = Total declared leakage of the project, estimated at baseline; tCO_2e
- $\mathbf{L}_i^{ha}$ = Estimated leakage of the hosting area i; tCO_2e
- $\mathbf{L}_i^{da}$ = Estimated leakage of the displaced activity area i; tCO_2e

Site Preparation Emissions Quantification

This section describes how any potential GHG emissions related to intensive site preparation techniques are quantified.

7.3.4 Intensive site preparation techniques may include the use of chemicals, prescribed burns, transitory non-native species, and mechanical intervention. Refer to the *Site Preparation* section and *Appendix C* for more details. The table below indicates which techniques require the potential quantification of GHG emissions and the corresponding methods applied.

Site Preparation Technique	Emission(s) accounted for?	Methodology/Justification
Prescribed burn	Yes	See requirement 2.1 below.
Use of fertilisers	Yes	See requirement 2.2 below.
Use of herbicides	No	The emissions related to the use of herbicides are considered *de minimis.*
Transitory non-native species	Yes	The AGB change related to the planting and subsequent removal of transitory non-native species is already accounted for via the procedure described in the *Carbon Stock and Baseline Estimation* section.
Mechanical Intervention	No	The burning of fossil fuels related to the use of heavy machinery is considered *de minimis.* Since the current methodology does not allow for soil inversion deeper than 25 cm, there are no implications for SOC.

Prescribed Burn

7.3.5 Equitable Earth follows a Tier 1 approach to estimate GHG emissions from prescribed burning, according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.[12]

7.3.6 Under the Tier 1 Approach, the mass of fuel available for combustion only includes biomass (AGB and BGB). Tier 1 assumes that carbon stocks in dead wood and litter pools in non-forest land are zero.

7.3.7 Quantification of CO_2 emissions and non-CO_2 GHG emissions, including methane (CH_4) and nitrous oxide (N_2O), resulting from prescribed burning as a site preparation technique, is obtained using equation (13) and derived from equations (14) and (15):

[12] Per the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, a tier defines a methodological complexity level for estimating greenhouse gas (GHG) emissions. Three tiers are outlined, with Tier 1 representing the least complex approach. Due to scaling constraints arising from the impracticality of collecting field data for every Equitable Earth-certified Project, Equitable Earth employs a Tier 1 methodology under M001. This approach may be revised in future iterations of the methodology.

$$\mathbf{E}_{total-burn} = \mathbf{E}_{burn} + \mathbf{E}_{burn}' \quad (13)$$

Where:

- $\mathbf{E}_{total-burn}$ = Total amount of CO_2e emissions from prescribed burning across corresponding intervention area(s); tCO_2e
- $\mathbf{E}_{burn}$ = Amount of CO_2 emissions from prescribed burning across corresponding intervention area(s); tCO_2
- $\mathbf{E}_{burn}$' = Amount of non-CO_2 emissions (CH_4 and N_2O) from prescribed burning across corresponding intervention area(s); tCO_2e

$$\mathbf{E}_{burn} = \sum_{i=1}^{n} (\mathbf{A}_{burn,i} \times \mathbf{AGB}_{site,i} \times (1 + \mathbf{RS}) \times \mathbf{CF} \times \mathbf{fd} \times \frac{44}{12}) \quad (14)$$

Where:

- $\mathbf{E}_{burn}$ = Amount of CO_2 emissions from prescribed burning across all intervention areas; tCO_2
- $\mathbf{A}_{burn,i}$ = Area burnt on intervention area *i*; ha
- $\mathbf{AGB}_{site,i}$ = Mass of above-ground biomass stock available for combustion on intervention area *i*; tDM/ha
- **RS** = Ratio of below-ground biomass to above-ground biomass; tDM BGB·tDM AGB^{-1}. Since Equitable Earth considers a Tier 1 approach, no changes to BGB are assumed, so RS is considered to be zero.
- **CF** = Carbon fraction of dry biomass; tC/tDM
- **fd** = Fraction of biomass lost in disturbance; dimensionless[13]
- $\frac{44}{12}$ = Molecular weight ratio of CO_2 to carbon; dimensionless

[13] The parameter **fd** defines the proportion of biomass that is lost from the biomass pool. It is assumed that a fire disturbance will 'kill all' and therefore fd = 1 in all cases. Equation (14) does not specify the fate of the carbon removed from the biomass carbon stock. The Tier 1 assumption is that all of $\mathbf{E}_{burn}$ is emitted in the year of disturbance. Higher Tier methods assume that some of this carbon is emitted immediately and some is added to the dead organic matter pools (dead wood, litter) or HWP.

$$\mathbf{E}_{burn}' = \sum_{i=1}^{n} (\mathbf{A}_{burn,i} \times \mathbf{AGB}_{site,i} \times \mathbf{C}_{f} \times \mathbf{G}_{ef,g} \times \mathbf{GWP}_{g}) \quad (15)$$

Where:

- $\mathbf{E}_{burn}'$ = Amount of non-CO_2 emissions (CH_4 and N_2O) from prescribed burning across all intervention areas; tCO_2e
- $\mathbf{A}_{burn,i}$ = Area burnt on intervention area *i*; ha
- $\mathbf{AGB}_{site,i}$ = Mass of above-ground biomass stock available for combustion on intervention area *i*; tDM/ha
- $\mathbf{C}_{f}$ = Combustion factor; dimensionless
- $\mathbf{G}_{ef,g}$ = Emission factor of dry matter burnt per gas *g*; tGHG/tDM
- $\mathbf{GWP}_{g}$ = Global warming potential per gas *g*; dimensionless

Use of Fertilisers

7.3.8 Quantification of N_2O emissions resulting from the use of fertilisers as a site preparation technique is obtained using equation (16), derived from equations (17) to (22):

$$\mathbf{E}_{chem} = \mathbf{E}_{Ndirect} + \mathbf{E}_{Nindirect} \quad (16)$$

Where:

- $\mathbf{E}_{chem}$ = Amount of CO_2e emissions stemming from N_2O emissions from the use of nitrogen fertiliser; tCO_2e
- $\mathbf{E}_{Ndirect}$ = Amount of direct CO_2e emissions stemming from N_2O emissions from the use of fertiliser across the corresponding intervention area(s); tCO_2e

- $\mathbf{E}_{Nindirect}$ = Amount of indirect CO_2e emissions stemming from N_2O emissions from the use of fertiliser across the corresponding intervention area(s); tCO_2e

$$\mathbf{E}_{Ndirect} = \sum_{i=1}^{n} [(\mathbf{SF}_i + \mathbf{OF}_i) \times \mathbf{EF}_{Ndirect} \times \frac{44}{28} \times \mathbf{GWP}_{N_2O}] \tag{17}$$

Where:

- $\mathbf{E}_{Ndirect}$ = Direct CO_2e emissions stemming from N_2O emissions from the use of fertiliser across the corresponding intervention area(s); tCO_2e
- $\mathbf{SF}_i$ = Amount of synthetic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{OF}_i$ = Amount of organic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{EF}_{Ndirect}$ = Emission factor for nitrous oxide emissions from N additions due to synthetic fertilisers, organic amendments and crop residues; tN_2O-N/tN applied
- $\frac{44}{28}$ = Molecular weight ratio of N_2O to nitrogen; dimensionless
- $\mathbf{GWP}_{N_2O}$ = Global Warming Potential for nitrous oxide; dimensionless

$$\mathbf{SF}_i = \mathbf{M}_{SF,i} \times \mathbf{C}_{SF,i} \tag{18}$$

Where:

- $\mathbf{SF}_i$ = Amount of synthetic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{M}_{SF,i}$ = Mass of N-containing synthetic fertiliser applied in intervention area *i*; t fertiliser

- $\mathbf{C}_{SF,i}$ = N content of synthetic fertiliser applied in intervention area *i*; tN/t fertiliser

$$\mathbf{OF}_{i} = \mathbf{M}_{OF,i} \times \mathbf{C}_{OF,i} \quad (19)$$

Where:

- $\mathbf{OF}_{i}$ = Amount of organic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{M}_{OF,i}$ = Mass of N-containing organic fertiliser applied in intervention area *i*; t fertiliser
- $\mathbf{C}_{OF,i}$ = N content of organic fertiliser applied in intervention area *i*; tN/t fertiliser

$$\mathbf{E}_{Nindirect} = \sum_{i=1}^{n} (\mathbf{V}_{N,i} + \mathbf{L}_{N,i}) \quad (20)$$

Where:

- $\mathbf{E}_{Nindirect}$ = Indirect CO_2e emissions stemming from N_2O emissions from the use of fertiliser across all intervention areas; tCO_2e
- $\mathbf{V}_{N,i}$ = CO_2e emissions stemming from indirect N_2O emissions produced from atmospheric deposition of N volatilised due to nitrogen fertiliser use in intervention area *i*; tCO_2e
- $\mathbf{L}_{N,i}$ = CO_2e emissions stemming from indirect N_2O emissions produced from leaching and runoff of N, in regions where leaching and runoff occur, due to nitrogen fertiliser use in intervention *i*; tCO_2e

$$\mathbf{V}_{N,i} = [(\mathbf{SF}_{i} \times \mathbf{F}_{SFvol}) + (\mathbf{OF}_{i} \times \mathbf{F}_{OFvol})] \times \mathbf{EF}_{Nv} \times \frac{44}{28} \times \mathbf{GWP}_{N_2O} \quad (21)$$

Where:

- $\mathbf{V}_{N,i}$ = CO_2e emissions stemming from indirect N_2O emissions produced from atmospheric deposition of N volatilised due to nitrogen fertiliser use in intervention area *i*; tCO_2e
- $\mathbf{SF}_{i}$ = Amount of synthetic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{F}_{SFvol}$ = Fraction of all synthetic nitrogen added to soils, volatilising as NH_3 and NO_x; (kg NH_3–N + NO_x–N)/(kgN applied)
- $\mathbf{OF}_{i}$ = Amount of organic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{F}_{OFvol}$ = Fraction of all organic nitrogen added to soils, volatilising as NH_3 and NO_x; (kg NH_3–N + NO_x–N)/(kg N applied or deposited)
- $\mathbf{EF}_{Nv}$ = Emission factor for nitrous oxide emissions from atmospheric deposition of N on soils and water surfaces; kg N_2O–N/(kg NH_3–N + NO_x–N volatilised)
- $\frac{44}{28}$ = Molecular weight ratio of N_2O to Nitrogen, which is 44/28; dimensionless
- $\mathbf{GWP}_{N_2O}$ = Global Warming Potential for nitrous oxide; dimensionless. This factor is used to convert the N_2O-related units into CO_2e.

$$\mathbf{L}_{N,i} = (\mathbf{SF}_{i} + \mathbf{OF}_{i}) \times \mathbf{F}_{Fleach} \times \mathbf{EF}_{Nl} \times \frac{44}{28} \times \mathbf{GWP}_{N_2O} \quad (22)$$

Where:

- $\mathbf{L}_{N,i}$ = CO_2e emissions stemming from indirect N_2O emissions produced from leaching and runoff of N, in regions where leaching and runoff occur, due to nitrogen fertiliser use in intervention *i*; tCO_2e
- $\mathbf{SF}_{i}$ = Amount of synthetic nitrogen fertiliser applied in intervention area *i*; tN
- $\mathbf{OF}_{i}$ = Amount of organic nitrogen fertiliser applied in the intervention area *i*; tN

- $\mathbf{F}_{Fleach}$ = Fraction of synthetic or organic nitrogen added to soil lost through leaching and/or runoff, where applicable; kgN/(kg of N additions)
- $\mathbf{EF}_{Nl}$ = Emission factor for nitrous oxide emissions from N leaching and/or runoff; kg N_2O–N/(kg N leaching/runoff)
- $\frac{44}{28}$ = Molecular weight ratio of N_2O to nitrogen; dimensionless
- $\mathbf{GWP}_{N_2O}$ = Global Warming Potential for nitrous oxide; dimensionless

Total Site Preparation Emissions

7.3.9 Quantification of total emissions stemming from site preparation techniques (i.e. prescribed burns and use of fertilisers) is obtained using equation (23):

$$\mathbf{E}_{sp} = \mathbf{E}_{total-burn} + \mathbf{E}_{chem} \quad (23)$$

Where:

- $\mathbf{E}_{sp}$ = Total emissions from site preparation techniques; tCO_2e
- $\mathbf{E}_{total-burn}$ = Total amount of CO_2e emissions from prescribed burning across corresponding intervention area(s); tCO_2e
- $\mathbf{E}_{chem}$ = Amount of CO_2e emissions stemming from N_2O emissions from the use of nitrogen fertiliser; tCO_2e

Projected Baseline

7.3.10 Equitable Earth calculates the carbon potential of the project by integrating baseline projections. This projected baseline is established at the pixel-level, through the historical rate of AGB change observed in the project area over the 3 or 5-year historical period before the project start date, depending on project context.

7.3.11 If a positive trend is identified, the slope of this trend is projected as the expected future AGB increase in the corresponding pixel. This slope is then deducted from the estimated carbon potential on the restoration site.

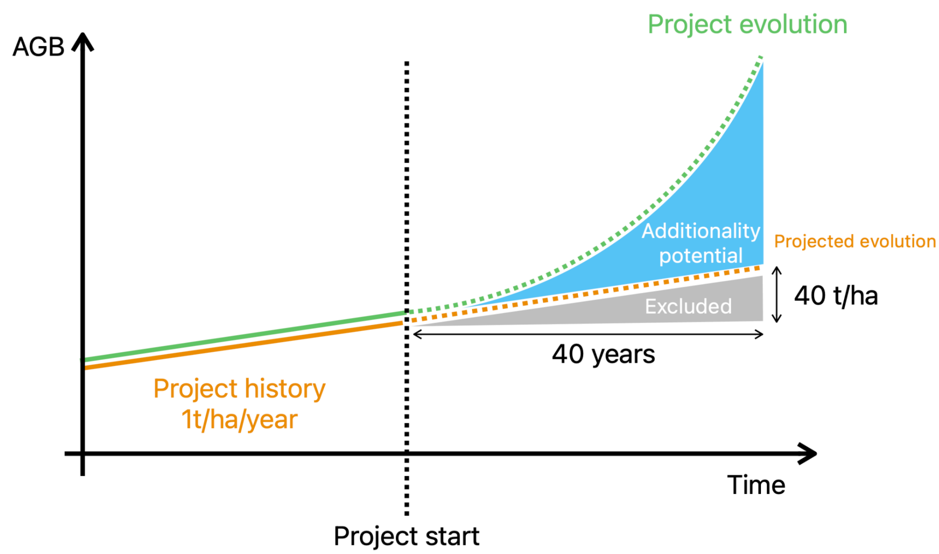

Figure 1: Projected evolution of the dynamic baseline with historical data showing a positive trend

7.3.12 If the trend is neutral or negative, the baseline will be assumed constant over the project lifetime in the corresponding pixel.

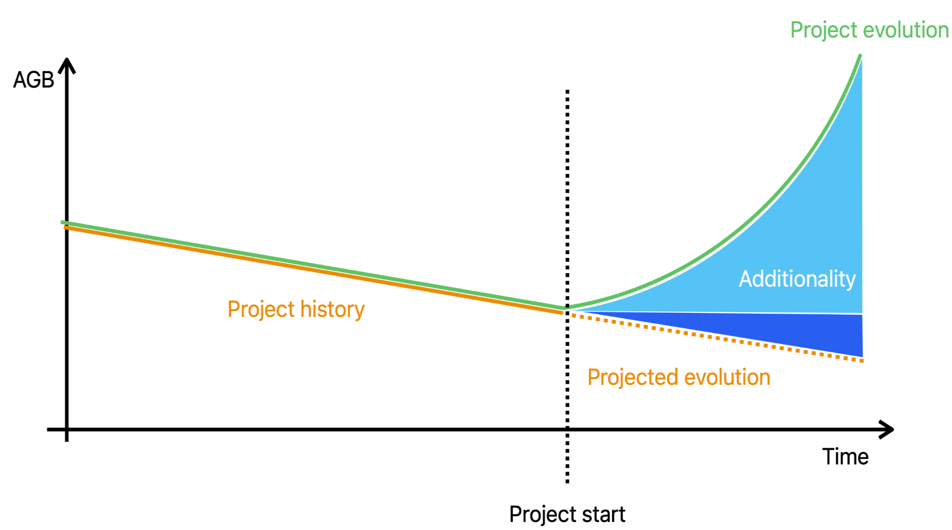

Figure 2: Projected evolution of the dynamic baseline with historical data showing a negative trend

7.3.13 The projected dynamic baseline is determined by equation (35):

$$\mathbf{DB}_{projected} = \sum_{i=1}^{n} max(0, \left[\frac{(\mathbf{C}_{pixel-gain\, i,0} - \mathbf{C}_{pixel-gain\, i,\, historical}) \times \mathbf{A}_{pixel\, i}}{\Delta t_{historical}} \right] \times t_{cp}) \quad (35)$$

Where:

- $\mathbf{DB}_{projected}$ = Projected evolution of the project's dynamic baseline over the project's lifetime; tCO_2e
- $\mathbf{C}_{pixel-gain\, i,\, historical}$= Per-hectare carbon stock of the pixel i in the restoration site(s), based on historical AGB data; tCO_2e/ha
- $\mathbf{C}_{pixel-gain\, i,\, 0}$ = Per-hectare carbon stock of the pixel i in the restoration site(s) at baseline; tCO_2e/ha
- $\mathbf{A}_{pixel\, i}$ = Size of the pixel i, ha
- $\Delta t_{historical}$ = Time interval between the date of the historical AGB dataset selected and baseline; years
- t_{cp} = Duration of the crediting period; years

7.4 GHG Removal Capacity and Carbon Potential

GHG Removal Capacity of the Restoration Site

7.4.1 The GHG removal capacity corresponds to the estimated maximum carbon stock increase the project is capable of achieving if it reaches $\mathbf{C}_{ref}$.

7.4.2 Equitable Earth determines a distribution of the project GHG removal capacity by using a Monte Carlo approach. At each iteration, $\mathbf{C}_{capacity}$ is determined using equation (24):

$$\mathbf{C}_{capacity} = (\mathbf{A}_{rest} \times \overline{\mathbf{C}_{ref}}) - \mathbf{C}_{rest,0} \quad (24)$$

Where:

- $\mathbf{C}_{capacity}$ = GHG removal capacity of the project; tCO_2e
- $\mathbf{A}_{rest}$ = Size of the restoration site(s); ha
- $\overline{\mathbf{C}}_{ref}$ = Mean carbon stock of the reference site; tCO_2e/ha
- $\mathbf{C}_{rest,0}$ = Carbon stock of the restoration site(s) at baseline; tCO_2e

Net GHG Removal Capacity of the Project

7.4.3 Total estimation of net GHG removal is obtained using equation (25):

$$\mathbf{C}_{net-capacity} = \mathbf{P}_{15}(\mathbf{C}_{capacity} - \mathbf{DB}_{projected} - \mathbf{L} - \mathbf{E}_{sp}) \quad (25)$$

Where:

- $\mathbf{C}_{net-capacity}$ = Net GHG removals capacity of the project; tCO_2e
- $\mathbf{P}_{15}$ = indicates the 15th percentile, which corresponds to the lower 70% of the distribution
- $\mathbf{C}_{capacity}$ = GHG removal capacity of the project; tCO_2e
- $\mathbf{DB}_{projected}$ = Projected evolution of the dynamic baseline; tCO_2e
- $\mathbf{L}$ = Total declared leakage of the project, estimated at baseline; tCO_2e
- $\mathbf{E}_{sp}$ = Total emissions from site preparation techniques; tCO_2e

7.4.4 Equitable Earth reports the net GHG removal capacity in the GHG Parameters and Baseline Calculation Report.

Carbon Curve Modelling

7.4.5 Equitable Earth provides a carbon curve to developers.

7.4.6 For a detailed explanation of the carbon curve calculation methods, including a comprehensive explanation of the calculation process, the assumptions made, and factors influencing the accuracy of projections, please refer to the Protocol for Carbon Curve Modelling.

Carbon Potential of the Project

7.4.7 The carbon potential of the project is the estimated maximum carbon stock the project may achieve at the end of the crediting period.

7.4.8 Equitable Earth estimates the carbon potential by assessing whether the project is expected to reach its full $\mathbf{C}_{net-capacity}$ by the end of the crediting period.

7.4.9 To do so, Equitable Earth uses the carbon curve to model the project's expected unit issuance trajectory over time.

7.4.9.1 If the carbon curve indicates that the project reaches full net capacity within the crediting period, the carbon potential $\mathbf{C}_{potential}$ is set to equal the $\mathbf{C}_{net-capacity}$.

7.4.9.2 If the carbon curve indicates that the project will not reach full net capacity within the crediting period, the carbon potential $\mathbf{C}_{potential}$ is set to the projected net GHG removals achieved by the end of the crediting period, as determined by the carbon curve.

7.4.10 Equitable Earth reports the carbon potential in the GHG Parameters and Baseline Calculation Report.

8 Carbon Quantification for VRU Accounting

8.1 Biomass Evolution in the Restoration Site

8.1.1 Prior to each verification, Equitable Earth quantifies the carbon stock within the restoration site(s) to assess biomass evolution from the previous verification period. To do so, Equitable Earth uses a similar methodology as used for carbon potential to determine the current biomass of the restoration site(s):

8.1.2 The AGB provider generates an AGB map that estimates the AGB at the pixel level in raster format for the restoration site(s) at the end of the verification period, hereafter referred to as year t.

8.1.3 If requested by the developer, Equitable Earth may calibrate the AGB value using field data. This calibration must conform to the specifications set out in the Protocol for Field Data Calibration.

8.1.4 The BGB is estimated to be a proportion of its AGB as dictated by the root-to-shoot ratio (RS). The relationship between BGB and AGB is represented by the equation (26):

$$\mathbf{BGB}_{rest,\,t} = \mathbf{AGB}_{rest,\,t} \times \mathbf{RS} \tag{26}$$

Where:

- $\mathbf{BGB}_{rest,\,t}$ = BGB of the restoration site at year t; tDM
- $\mathbf{AGB}_{rest,\,t}$ = AGB of the restoration site at year t; tDM
- **RS** = Root-to-shoot ratio; dimensionless

8.1.5 The total biomass of the reference site is obtained using equation (27):

$$\mathbf{B}_{rest,t} = \mathbf{AGB}_{rest,t} + \mathbf{BGB}_{rest,t} \tag{27}$$

Where:

- $\mathbf{B}_{rest,\,t}$ = Total biomass of the restoration site at year t; tDM
- $\mathbf{BGB}_{rest,\,t}$ = BGB of the restoration site at year t; tDM
- $\mathbf{AGB}_{rest,\,t}$ = AGB of the restoration site at year t; tDM

8.1.6 The conversion to CO_2e is obtained using equation (28):

$$\mathbf{C}_{rest,\,t} = \frac{44}{12} \times \mathbf{CF} \times \mathbf{B}_{rest,\,t} \tag{28}$$

Where:

- $\mathbf{C}_{rest,\,t}$ = Carbon stock of the restoration site at year t; tCO_2e
- $\frac{44}{12}$ = Molecular weight ratio of CO_2 to carbon; dimensionless
- **CF** = Carbon fraction of tree biomass; tC/tDM
- $\mathbf{B}_{rest,\,t}$ = Total biomass of the restoration site at year t; tDM

8.2 Adjustment Factors

Leakage Quantification

This section describes how leakage is quantified throughout the project's crediting period.

Hosting Areas

8.2.1 If the developer is able to provide the hosting area(s), Equitable Earth assesses carbon stock changes at the pixel level within each hosting area. For each pixel, the change in carbon stock is evaluated between the start and end of the verification period. All pixels that show a carbon loss are included in the leakage calculation. The sum of these losses represents the leakage in the hosting area, which is deducted from the project's net GHG removals for the current verification.

$$L_{i,t}^{ha,\,period} = \sum_{s \in S_i} max(0;\, C_{s,t-t_{period}}^{ha} - C_{s,t}^{ha}),\ t \geq 1 \quad (29)$$

Where:

- $L_{i,t}^{ha,\,period}$ = Leakage identified during the last verification period in the hosting area i; tCO_2e
- $C_{s,t}^{ha}$ = Carbon stock in the pixels, at year t; tCO_2e
- t_{period} = Duration of the last verification period; years
- S_i = Subset of pixels in hosting area i where loss was identified; dimensionless

8.2.2 To monitor the evolution of leakage emissions throughout the crediting period, Equitable Earth compares the carbon stock of the hosting area(s) from one verification to another. However, leakage quantification is discontinued once the cumulative leakage emissions equal the full carbon stock capacity of the hosting area(s) as measured at baseline.

Displaced Activity Areas

8.2.3 If the developer cannot provide the hosting area(s), Equitable Earth uses the leakage belt to conservatively quantify leakage.

8.2.3.1 To estimate the carbon stock loss associated with the unknown hosting area(s), Equitable Earth analyses the leakage belt and identifies all pixels where forest loss has occurred during the previous verification period.

8.2.3.2 A conservative estimate of carbon loss is then calculated by determining the 95th percentile of the distribution of carbon stock loss across these pixels. This value is used to represent the mean carbon stock loss for leakage accounting purposes.

$$\mathbf{C}_{max-loss,t} = \mathbf{P}_{95}(\mathbf{C}_{loss-lb,t}) \quad (30)$$

Where:

- $\mathbf{C}_{max-loss,t}$ = Conservative estimate of the leakage belt per-hectare carbon loss during the last verification period; tCO2e/ha
- $\mathbf{P}_{95}$ = indicates the 95th percentile, which corresponds to the upper 90% of the distribution
- $\mathbf{C}_{loss-pixel,t}$ = Distribution of pixel-level per-hectare carbon loss in the leakage belt during the last verification period; tCO2e/ha

8.2.3.3 The resulting leakage from the activity is determined using equation (31):

$$\mathbf{L}_{i,t}^{da,\, period} = \mathbf{A}_{i}^{da} \times \mathbf{C}_{max-loss,t} \times \mathbf{P}_{i}\,,\ t \geq 1 \quad (31)$$

Where:

- $\mathbf{L}_{i,\,t}^{da,\, period}$ = Leakage identified during the last verification period in the displaced activity area i; tCO_2e
- $\mathbf{A}_{i}^{da}$ = Size of the displaced activity area i; ha
- $\mathbf{C}_{max-loss,t}$ = Conservative estimate of the leakage belt per-hectare carbon loss during the last verification period; tCO2e/ha
- $\mathbf{P}_{i}$ = Declared % of activity displacement of the activity in the displaced activity area i at baseline; dimensionless

Total leakage

8.2.3.4 Total leakage for the verification period is obtained by aggregating leakage derived from the hosting area(s) and displaced activity area(s), using equation (32):

$$\mathbf{L}_t^{period} = \sum_{i=1}^{n} \mathbf{L}_{i,t}^{ha,\, period} + \sum_{i=1}^{m} \mathbf{L}_{i,t}^{da,\, period} \tag{32}$$

Where:

- $\mathbf{L}_t^{period}$ = Leakage during the last verification period; tCO_2e
- $\mathbf{L}_{period,\, i}^{ha}$ = Leakage identified during the last verification period in the hosting area i; tCO_2e
- $\mathbf{L}_{i,\, t}^{da,\, period}$ = Leakage identified during the last verification period in the displaced activity area i; tCO_2e

8.2.4 Equitable Earth reserves the right to apply a more suitable leakage quantification method on a case-by-case basis if the developer provides additional data that yields a more accurate or conservative result. In such cases, Equitable Earth clearly and thoroughly documents the applied methods in the corresponding GHG Monitoring Report.

Quantification of Loss Events

8.2.5 In case of a loss event, Equitable Earth quantifies the GHG emissions associated with the area that experienced the loss event.

8.2.6 The carbon stock is calculated before and after the loss event, following the *Baseline Carbon Stock* calculation.

8.2.7 The carbon stock loss is obtained using equation (33):

$$\mathbf{C}_{loss-event} = \mathbf{C}_{post-event} - \mathbf{C}_{pre-event} \tag{33}$$

Where:

- $\mathbf{C}_{loss-event}$ = Impact of the loss event; tCO_2e
- $\mathbf{C}_{post-event}$ = Carbon stock of the area after the loss event; tCO_2e
- $\mathbf{C}_{pre-event}$ = Carbon stock of the area before the loss event; tCO_2e

Site Preparation Emissions

8.2.8 If any site preparation activities, as described in the *Site Preparation Emissions Quantification* section, have been undertaken by the developer, the related emissions must be accounted for from one verification to the next. Refer to the *Site Preparation Emissions Quantification* section and *Appendix C* for more details.

Dynamic Baseline

General Principles

8.2.9 The dynamic baseline calculation process is performed before each verification and may lead to the adjustment of unit issuance, following the procedures detailed in the Units & Issuance section of the Programme Manual.

8.2.10 The dynamic baseline is established by selecting control plots located outside both the project area and the leakage belt, with similar ecological and socioeconomic characteristics, including degradation levels. The study area extends from 5 km to 30 km beyond the project boundary, with the exact distance determined on a case-by-case basis depending on the landscape characteristics and data availability. These control plots provide a reference, enabling comparison of the project's outcomes against what would have occurred in a similar area without the project's interventions (i.e., in the baseline scenario). Equitable Earth includes shapefiles of the control plots in the GHG Parameters and Baseline Calculation Report and on the Equitable Earth Registry.

Identification of Control Plots

8.2.11 **Exclusion of Unsuitable Areas.**[14] The first step in selecting suitable control plots is to reduce the study area by excluding areas that are unsuitable for representing a valid business-as-usual scenario. This ensures the comparability of land-use and degradation dynamics. The following areas are systematically excluded:

8.2.11.1 **Areas located in different biomes:** Any area falling outside the biome(s) present within the project area is excluded, as ecological characteristics and natural dynamics vary significantly between biomes.

[14] IUCN and UNEP-WCMC (2022), The World Database on Protected Areas (WDPA), Cambridge, UK: UNEP-WCMC. Available at: www.protectedplanet.net. Accessed through Global Forest Watch in (10/2023). Available at: URL.

8.2.11.2 **Protected areas:** their conservation status makes them unsuitable for representing typical land-use scenarios.

8.2.11.3 **Active carbon projects:** these areas are unsuitable for comparison, as both the project and control plots are subject to the same treatment.

8.2.11.4 **Commercial plantations:** these areas are excluded due to different management practices and incentives (e.g., economic incentives for planting and harvesting), which make them incomparable to ecosystem restoration projects.

8.2.11.5 **Socio-political indicators.** Areas are excluded if located outside either the project's country or the same jurisdictional boundaries to ensure alignment with the socio-political context and regulatory frameworks.

8.2.11.6 **Non-vegetated areas.** Built-up infrastructure (e.g., roads, buildings) and permanent water bodies (e.g., lakes, reservoirs) are excluded as they do not support biomass growth or reflect relevant land-use dynamics.

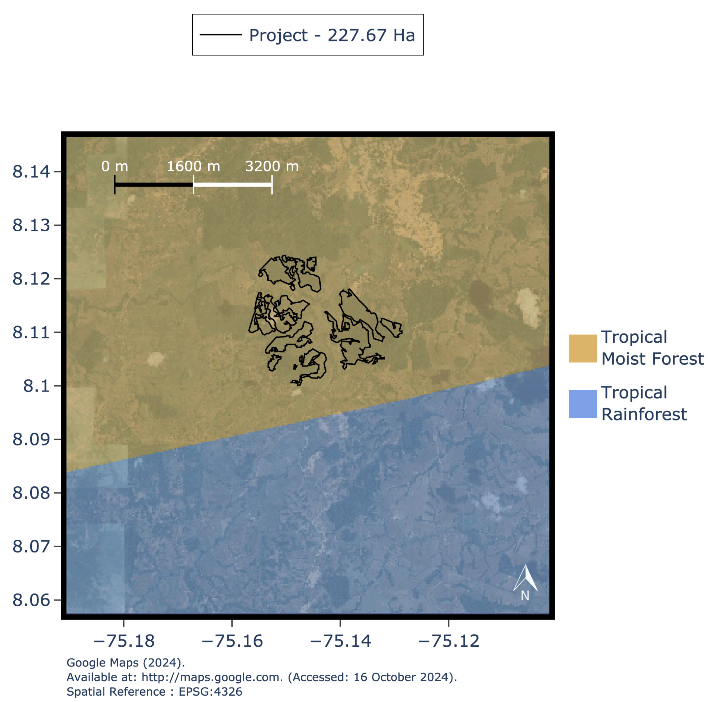

Figure 3: Map depicting the spatial boundary between two biomes and the project area shapefile

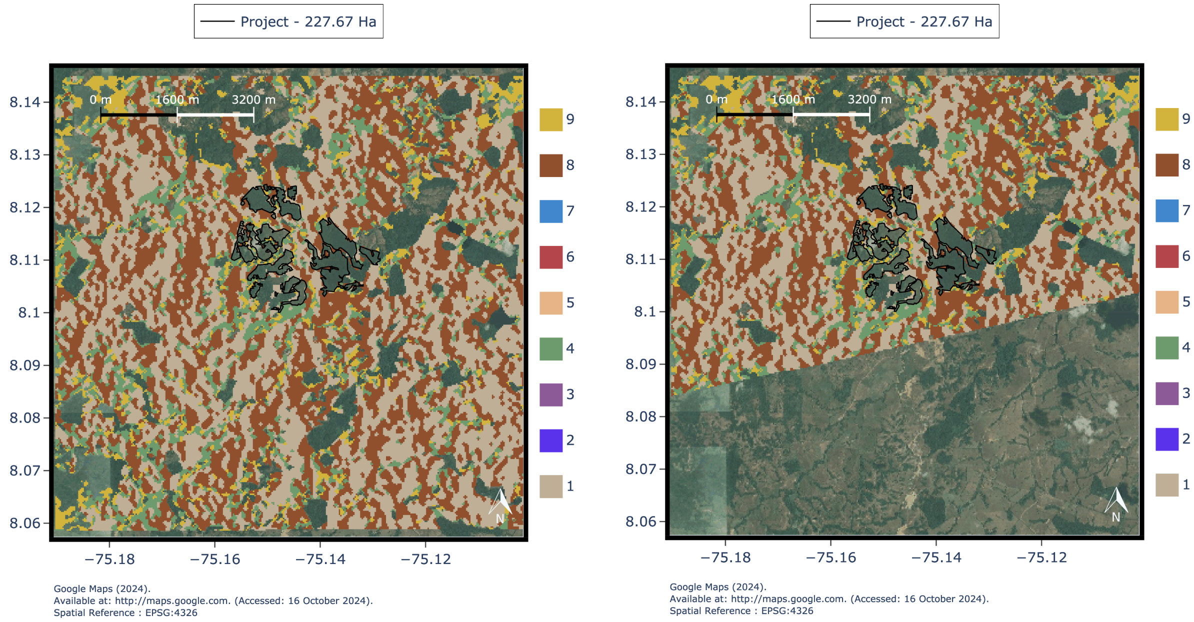

Figure 4: Before and after the exclusion of the area outside the project biomes

8.2.12 **Indicators.** The selection of control plots is based on the following indicators, which encompass ecological, climatic, and land use indicators:

1) elevation[15]
2) slope (derived from elevation)
3) aspect (derived from elevation)[16]
4) distance to roads[17]
5) AGB trends since 2000, using data from Chloris Geospatial.

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[15] Farr, T. G., et al. (2007). 'The Shuttle Radar Topography Mission'. Rev. Geophys., 45, RG2004. Available at: URL (Accessed 03/11/2023)

[16] Aspect identifies the direction of the maximum downward gradient for each specific point on a surface. It indicates the slope's orientation and helps in understanding factors such as sunlight exposure, wind patterns, and moisture retention on the Project Area.

[17] OpenStreetMap contributors. (2017). Available at: URL

💡 While Equitable Earth recognises the critical role of land tenure in ensuring both the longevity and equity of projects, M001 does not currently incorporate land tenure and ownership as indicators to select control plots due to the absence of comprehensive, publicly accessible global or national land tenure registries. However, Equitable Earth is actively exploring ways to integrate these considerations into future versions of M001.

8.2.13 **Clustering**. Based on the indicators mentioned above, the selected area for clustering is stratified using the K-means clustering algorithm. This statistical method identifies natural patterns within the dataset and enables the classification of the area into distinct subdivisions based on the chosen indicators. Each 'class' represents a grouping of areas with similar characteristics.

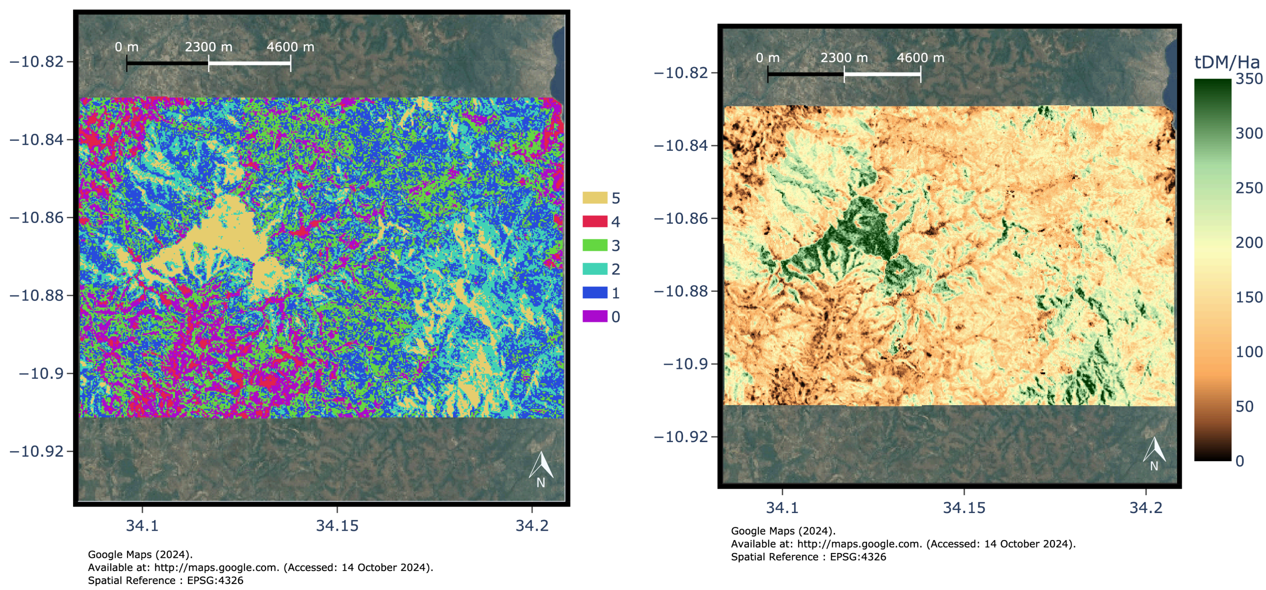

Figure 5: Clustering and AGB stock

8.2.14 **Cluster Integration**. Equitable Earth utilises cohesive spatial units instead of individual, isolated pixels. To achieve this, neighbouring pixels are grouped to create larger, cohesive areas that better represent the overall landscape characteristics. During this grouping process, any pixel that belongs to multiple classes will be assigned to the most dominant class in its immediate surroundings. Similarly, pixels not assigned to any class will be allocated to the dominant surrounding class.

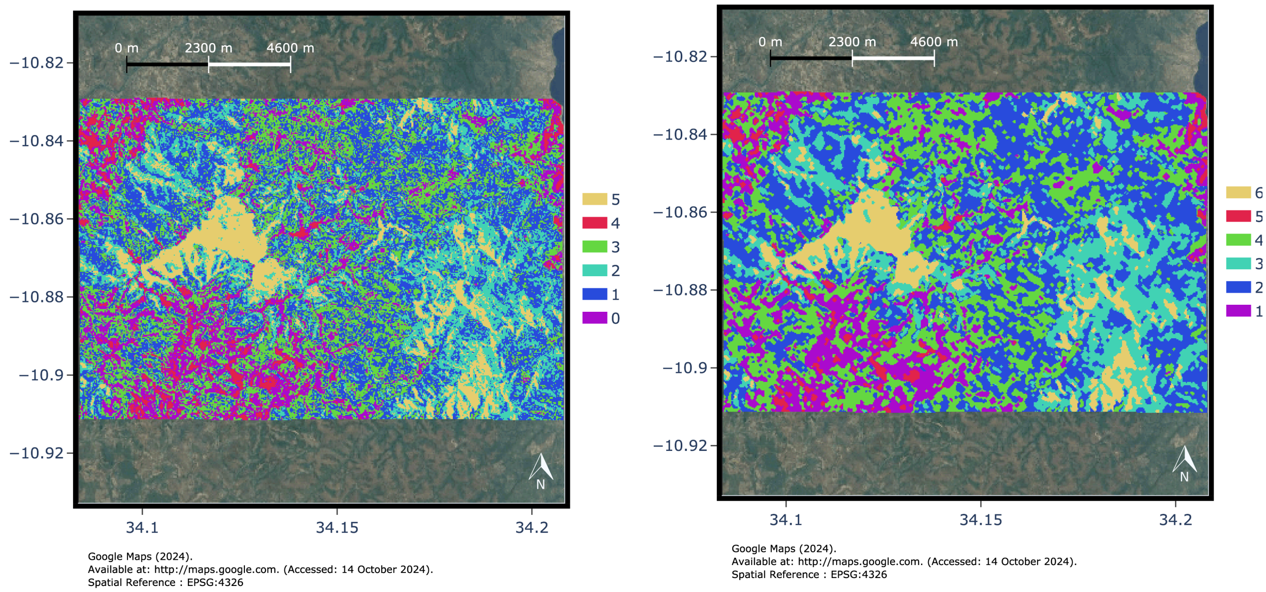

Figure 6: Grouping of clusters

8.2.15 **Matching**. Once clustering and grouping are complete, only classes that correspond to those present within the restoration site(s) are retained for further analysis.

Dynamic Evaluation

Equitable Earth performs a dynamic evaluation of the baseline before each verification.

8.2.16 **Refinement of Control Plots**. Before every net GHG removal calculation, Equitable Earth reviews the relevance of control plots using the methodology detailed in the *Identification of Control Plots* section. If current control plots are deemed no longer representative or valid, new control plots must be identified and generated following the established procedure.

8.2.17 **Assessment of Control Plots.** For each cluster, the average change in carbon stock across all control plots is obtained using equation (34):

$$\mathbf{DB}_t^{period} = \sum_{i=1}^{n}\left[\left(\overline{\mathbf{C}_{i,t}^{cluster}} - \overline{\mathbf{C}_{i,t-t_{period}}^{cluster}}\right) \times \mathbf{A}_i^{cluster}\right] \quad (34)$$

Where:

- $\mathbf{DB}_{t}^{period}$ = Corrected dynamic baseline during the last verification period; tCO_2e
- $\overline{\mathbf{C}_{i,t}^{cluster}}$ = Mean carbon stock of the control plots classified under the cluster i at year t; tCO_2e/ha
- $\mathbf{A}_{i}^{cluster}$ = Size of the project area classified under cluster i; ha
- t_{period} = Duration of the last verification period; years

8.2.18 Following the assessment of control plots, two distinct scenarios may arise:

8.2.18.1 An upward trend in the mean carbon stock of control plots from the project start to the present verification period indicates positive forest growth. In this case, the baseline must be adjusted to reflect this increase. The AGB increase in control plots must be factored into the baseline recalculations.

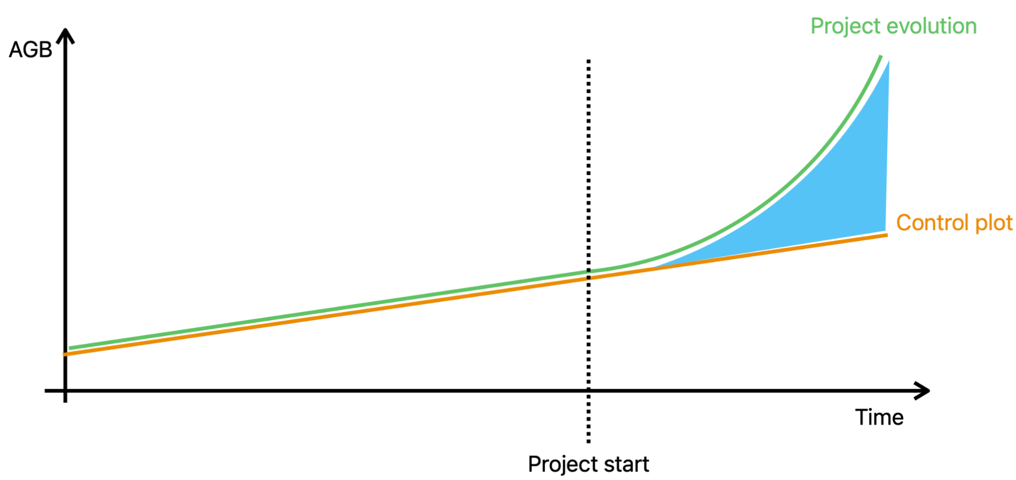

Figure 7: Positive Growth with Slight Baseline Increase

8.2.18.2 A downward trend in the mean carbon stock of control plots from the project start to the present verification period indicates forest degradation or loss. In this case, the baseline must be maintained at the AGB value from the previous verification period. This conservative approach prevents the project from claiming units for avoided emissions due to a declining baseline, which could result in potential over-issuance during future periods.

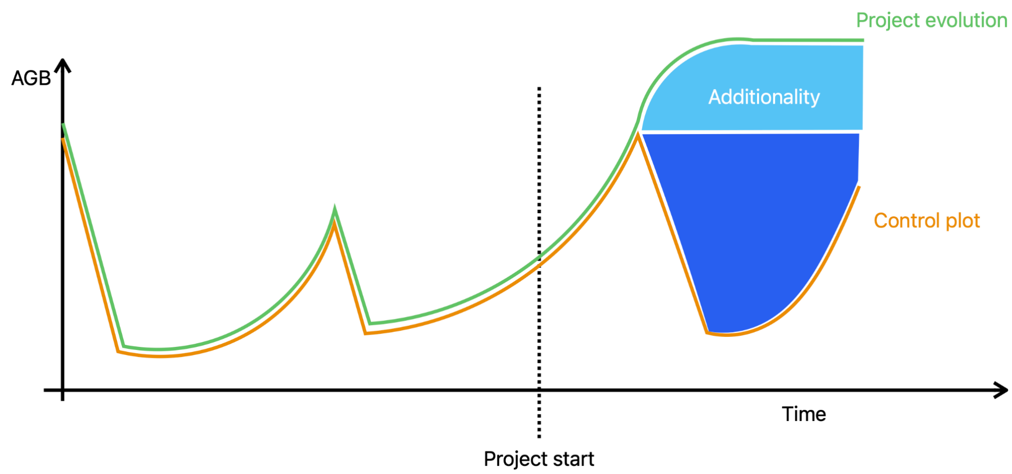

Figure 8: Project additionality despite fluctuating dynamic baseline

8.3 VRU Accounting

8.3.1 VRUs are issued after verification and throughout the project crediting period. Before each verification, Equitable Earth measures carbon stock in the restoration site(s), factoring in the elements outlined below.

8.3.1.1 **Biomass evolution in the restoration site(s):** calculated by comparing the total biomass at each year t with the total biomass at baseline. This evaluation includes any loss events that occurred on the restoration site(s) since the project start date. This is then converted to carbon stock evolution at the restoration site(s)

8.3.1.2 **Leakage quantification:** the leakage evolution observed since the previous verification.

8.3.1.3 **Baseline correction:** the carbon stock evolution monitored in the control plots since the previous verification.

8.3.1.4 **Prior issuance correction:** the volume of VRUs issued in the previous verification period.

8.3.1.5 **Loss event correction:** GHG emissions associated with any loss events that occurred during the verification period.

8.3.2 Total VRUs for the last verification period are calculated following equation

(35):

$$\mathbf{VRU}_t = \mathbf{P}_{15}(\mathbf{C}_{rest,t} - \mathbf{L}_t^{period} - \mathbf{DB}_t^{period}) - \mathbf{VRU}_{t-t_{period}} - \mathbf{C}_{loss-event} \quad (35)$$

Where:

- $\mathbf{VRU}_t$ = Verified Restoration Unit issued for the verification period ending at year t; tCO_2e
- $\mathbf{P}_{15}$ = indicates the 15th percentile, which corresponds to the lower 70% of the distribution
- $\mathbf{C}_{rest,t}$ = Carbon stock of the restoration site at year t; tCO_2e
- $\mathbf{C}_{rest,0}$ = Carbon stock of the restoration site at baseline; tCO_2e
- $\Delta\mathbf{L}_t$ = Leakage identified during the last verification period; tCO_2e
- $\Delta\mathbf{DB}_t$ = Corrected dynamic baseline at year t; tCO_2e
- t_{period}= Duration of the last verification period; years
- $\mathbf{C}_{loss-event}$ = Impact of the loss event, if applicable; tCO_2e

8.3.3 If $\mathbf{VRU}_t$ is negative, this indicates a reversal. In such cases, the project must follow the procedures outlined in the *Compensation for Reversals* section of the Programme Manual.

9 Uncertainty & Conservativeness

This section describes how Equitable Earth accounts for uncertainty and the rules enforced to ensure conservative carbon estimations.

9.1 Uncertainty

9.1.1 Equitable Earth accounts for uncertainty in carbon estimation by incorporating standard errors at multiple stages of the biomass quantification process. Two primary sources of uncertainty are explicitly included in the estimation of total carbon stock:

1) AGB uncertainty

2) root-to-shoot (RS) ratio uncertainty (affecting the calculation of BGB)

9.1.2 These uncertainties are integrated at the pixel level and extended to the project through the Monte Carlo simulation. Refer to the *Monte Carlo Simulation* section for more details.

AGB Model Uncertainty

9.1.3 **Pixel-Level Uncertainty.** Equitable Earth uses a model from the AGB provider to generate AGB maps, including a pixel-level standard error for AGB density (AGBD) change estimates at the 95% confidence level. This uncertainty is derived from a map of standard error, based on error propagation analysis across all layers in the time series.

9.1.3.1 The standard error is calculated by considering geolocation, allometric, and model-based errors for AGBD predictions at each time point. The confidence interval for each pixel trajectory is then used to determine the standard error of the AGBD change. Reported AGBD change statistics are based on the sum of significant pixel-level changes (p-value ≤ 0.05).

9.1.4 **Site-Level Uncertainty.** To estimate AGB uncertainty at the site level, Equitable Earth applies Monte Carlo simulations[18]. This approach accounts for variability in pixel-level uncertainties, ensuring robust estimates for large datasets and when spatial correlations are present. Refer to the *Monte Carlo Simulation* section for more details.

[18] Galbally, I. E. (2000). Good practice guidance and uncertainty management in national greenhouse gas inventories: Recent developments.

RS Model Uncertainty

9.1.5 Equitable Earth creates a probability distribution for the RS ratio. For each pixel, the RS is treated as a log-normal distribution defined by a mean and standard deviation corresponding to the pixel's biome and AGB class. This allows for the propagation of uncertainty stemming from the RS variability into BGB estimation.

9.1.6 **Site-Level Uncertainty.** Equitable Earth incorporates RS uncertainty into the broader carbon estimation process through Monte Carlo simulations. In each iteration, a value of RS is randomly drawn from the log-normal distribution for each pixel. This value is then applied to the corresponding AGB to generate a pixel-level BGB estimate.

9.1.6.1 This dual-source uncertainty treatment ensures that all carbon estimates produced by Equitable Earth reflect both pixel-level measurement error. These estimates are always expressed as distributions and used conservatively for unit issuance.

9.2 Conservativeness

The conservative approach applied by Equitable Earth consistently and systematically selects the uncertainty boundary to maintain the most conservative estimates. This prevents any potential overestimation of GHG removals. This section provides details about the conservative approach taken at each step.

9.2.1 **GHG Removal Capacity.** The methods applied by Equitable Earth ensure reliability through a conservative approach. Monte Carlo simulations are used to model uncertainty distribution in biomass estimates. Refer to the *Uncertainty* section for more details.

9.2.2 **Carbon Potential Accounting.** For the quantification of the project's carbon potential, the lower bound of the 70% confidence interval is chosen from the distribution generated by Monte Carlo simulations.

9.2.3 **VRU Accounting.** For the quantification of VRUs, the lower bound of the 70% confidence interval is chosen from the distribution generated by Monte Carlo simulations.

9.2.4 **Leakage.** Equitable Earth applies a conservative approach to account for leakage estimation and quantification. For carbon potential estimations, the biomass within the hosting area is conservatively assumed to be reduced to zero, reflecting a complete displacement of activities. At each verification, the leakage quantification is based on a conservative quantification, using the upper bound of the 90% confidence interval in the distribution of carbon loss in the leakage belt.

9.2.5 **Loss Events.** Equitable Earth conservatively considers a complete loss of BGB and consequently deducts both AGB and BGB from the carbon stock quantification.

Appendix A: AGB Provider

A1.1 Benchmark Process

The selection of a reliable AGB provider is crucial to achieving accurate carbon stock estimations. A benchmarking exercise was conducted to identify the most suitable AGB provider for Equitable Earth. The process overview is described below. Refer to the AGB Benchmark document for more details.

Initial Provider Contact

A1.1.1 Multiple AGB providers were invited to participate in the benchmarking process. Each received a shapefile document with geographic information of a forested area, to apply their AGB models and determine the corresponding values.

Model Output Comparison

A1.1.2 Equitable Earth uses the AGB model outputs from each provider to gather key statistical information, compared across providers. Additionally, a detailed comparison is conducted within selected sub-areas against a designated reference model.

Selection Criteria

A1.1.3 **Precision:** the accuracy of the AGB model in predicting biomass values.

A1.1.4 **Uncertainty analysis:** the methodology for calculating uncertainty and how it is propagated from field measurements to the final AGB model.

A1.1.5 **Coverage:** the extent of the area the model could cover and its flexibility in application.

A1.1.6 **Integration feasibility:** the practicality and efficiency of integrating the model into the Equitable Earth certification process.

Conclusion

A1.1.7 Based on the established criteria, the AGB provider best suited to deliver rigorous, conservative, and accurate data was selected for integration into

Equitable Earth methodologies. For this version of the methodology, Chloris Geospatial has been selected as the primary AGB provider. In cases where Chloris Geospatial is unable to provide timely AGB maps for required areas, Equitable Earth has appointed Kanop as an alternative provider to maintain continuous data availability.

Iteration

A1.1.8 The benchmarking process may be repeated at any time and will occur at a minimum every two years, following the Standard Setting and Methodology Development Procedure. Equitable Earth is committed to using data providers that uphold the principles and level of rigour outlined in this methodology. Regular updates to the benchmarking process enable Equitable Earth to ensure the continued suitability and reliability of its selected AGB provider.

A1.1.9 Equitable Earth may revise its choice of AGB provider following future benchmarking exercises. If such a change is made, it will be communicated through official updates and publicly available documentation.

Appendix B: Carbon Parameters

B1.1 Parameters Available at Validation

Data/Parameter	$\mathbf{SE}_{pixel,0}$
Data unit	tDM
Description	Standard error from the AGB provider for each pixel at baseline.
Source of data	AGB provider
Value applied	Project-specific
Quality Assurance	Refer to Quality Assurance of $AGB_{rest,0}$
Quality Control	Refer to Quality Control of $AGB_{rest,0}$

Data/Parameter	ϱ
Data unit	Dimensionless
Description	Correlation factor between the pixels.
Equations	(1)
Source of data	AGB provider
Value applied	0.01
Quality Assurance	The correlation factor is provided as part of the AGB provider's model. A detailed analysis of the AGB provider methodology for AGB calculations is available here. Their model is accessed automatically via a secure API.
Quality Control	Equitable Earth retains documentation of the AGB provider's methodological specifications, including the correlation factor, and conducts regular check-ins to verify whether updates or methodological improvements have occurred.

Data/Parameter	$\mathbf{AGB}_{rest,0}$
Data unit	tDM
Description	Above-ground biomass of the restoration site at baseline

Equation(s)	(3), (4)
Source of data	AGB provider
Value(s) applied	Since the AGB provider publishes yearly data for AGB density around mid-year for the previous year, Equitable Earth uses: ● The y-2 data as the baseline for projects undergoing certification from January 1st to June 30th (included) of year y. ● The y-1 data as the baseline for projects undergoing certification (or expected to start) from July 1st to December 31st (included) of year y. ● The y-1 data as the baseline for projects having a start date in year y when pre-submission activities have been declared. The chosen baseline year (e.g., y-1 or y-2) will be used throughout the project's crediting period.
Quality Assurance	A detailed analysis of the AGB provider methodology for AGB calculations is available here. Their model is accessed automatically via a secure API.
Quality Control	Equitable Earth performs two different site-level quality controls: ● A series of automated tests within the pipeline that detect anomalies (e.g., impossible values). ● A visual review of possible artefacts such as climatic or Bidirectional Reflectance Distribution Function (BRDF) effects and, if required, verifying data with high-resolution imagery.

Data/Parameter	**RS**
Data unit	Dimensionless
Description	Root-to-shoot ratio. The root-to-shoot ratios applied are based on the 2019 updated values from the IPCC, which provides root-to-shoot (RS) values for each ecological zone across continents (Asia, Africa, North and South America), distinguishing between above-ground biomass values less than and greater than 125 tDM·Ha-1. Equitable Earth uses values specific to natural origins. [19]
Equations	(3), (6), (14), (26)
Source of data	IPCC 2019 Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	Region-specific and AGB-dependent

[19] Calvo Buendia, E., Tanabe, K., Kranjc, A., Baasansuren, J., Fukuda, M., Ngarize, S., Osako, A., Pyrozhenko, Y., Shermanau, P. and Federici, S. (2019). 'IPCC 2019, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories'. Published: IPCC, Switzerland. Volume 4, Chapter 4, Table 4.4, p 4.18. Available at: URL (Accessed 27/05/2024)

Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Programme and/or relevant methodologies.

Data/Parameter	**CF**
Data unit	tC/tDM
Description	Carbon fraction of dry biomass
Equation(s)	(5), (8), (14), (28)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.47
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Programme and/or relevant methodologies.

Data/Parameter	$\mathbf{AGB}_{ref}$
Data unit	tDM
Description	Above-ground biomass of the reference site.
Equations	(7)
Source of data	AGB provider
Value applied	Similarly to baseline, since the AGB provider publishes yearly data for AGB density around mid-year for the previous year, Equitable Earth uses: ● The y-2 data as the baseline for Projects undergoing certification from January 1st to June 30th (included) of year y. ● The y-1 data as the baseline for Projects undergoing certification (or expected to start) from July 1st to December 31st (included) of year y. ● The y-1 data as the baseline for Projects having a Start date in year y when pre-submission activities have been declared.
Quality Assurance	Refer to Quality Assurance of $\mathbf{AGB}_{rest,0}$.

Quality Control	Refer to Quality Control of $\mathbf{AGB}_{rest,0}$.

Data/Parameter	$\mathbf{A}_{ref}$
Data unit	ha
Description	Reference site area
Equation(s)	(9)
Source of data	Developer with GIS data
Value(s) applied	Project-specific
Quality Assurance	Relevant stakeholders are consulted to determine the reference site. The results of the consultation can be found in the Project Design Document.
Quality Control	Equitable Earth visually validates the reference site area using GIS tools and satellite data.

Data/Parameter	$\mathbf{A}_i^{da}$
Data unit	ha
Description	Declared area of a leakage activity i located in the project area.
Equation(s)	(11), (31)
Source of data	Developer with GIS data
Value(s) applied	Project-specific
Quality Assurance	Relevant stakeholders are consulted to get a precise understanding of the leakage activities and their areas. The results of the consultation can be found in the Project Design Document.
Quality Control	Equitable Earth visually validates the displaced activity area(s) using GIS tools and satellite data.

Data/Parameter	$\mathbf{A}_i^{cluster}$
Data unit	ha
Description	Area of the project classified under cluster i

Equation(s)	(34)
Source of data	Equitable Earth with GIS Data
Value(s) applied	Project-specific
Quality Assurance	The method for identifying clusters is explained under the *Dynamic Baseline* section and has been tested across multiple projects to demonstrate its consistency and robustness.
Quality Control	Equitable Earth calculates the Silhouette Score and Davies-Bouldin Index to assess the quality of clustering. The thresholds for these indicators vary depending on the project and are defined on a case-by-case basis.

Data/Parameter	**fd**
Data unit	Dimensionless (%)
Description	Fraction of biomass lost in the disturbance event (i.e. prescribed burn in this case)
Equation(s)	(14)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 2 (page 18)
Value(s) applied	1
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Programme and/or relevant Methodologies.

Data/Parameter	C_f
Data unit	Dimensionless
Description	Combustion factor (proportion of pre-fire fuel biomass consumed)
Equation(s)	(15)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 2, Table 2.6
Value(s) applied	Ecosystem dependent (see table in the IPCC document)
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.

Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant Methodologies.

Data/Parameter	$G_{ef,g}$
Data unit	gGHG/kgDM
Description	Emission factor of dry matter burnt per gas g
Equation(s)	(15)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 2, Table 2.5
Value(s) applied	GHG dependent (see table in the IPCC document)
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	GWP_g
Data unit	Dimensionless
Description	Global warming potential per gas *g*
Equation(s)	(15), (17), (21), (22)
Source of data	IPCC's Sixth Assessment Report (AR6)
Value(s) applied	GHG dependent. Default values applied by Equitable Earth are defined under the ***General Principles*** section of the Equitable Earth Standard.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	$EF_{Ndirect}$
Data unit	tN2O-N/tN applied

Description	Emission factor for nitrous oxide emissions from N additions due to synthetic fertilisers, organic amendments and crop residues.
Equation(s)	(17)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11, Table 11.1
Value(s) applied	0.03 The IPCC applies a default value of 0.01 with an uncertainty range of 0.003 - 0.03. Due to a lack of scalable field data on a per-project basis in this version of the Quantification Methodology, Equitable Earth applies the most conservation value.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	$\mathbf{C}_{SF,\,i}$
Data unit	tN/t fertiliser
Description	N content of synthetic fertiliser applied in intervention area *i*
Equation(s)	(18)
Source of data	N content is determined following the fertiliser manufacturer's specifications.
Value(s) applied	Product-dependent, as indicated in the restoration plan by the developer.
Quality Assurance	• The developer confirms that all information provided in the Project Design Document is accurate. • The developer provides the name, brand and content for each chemical/fertiliser applied. • The developer indicates the N-content of the mass of chemical/fertiliser applied, which is cross-referenced with the name, brand, and content of said chemical/fertiliser provided in the restoration plan.
Quality Control	The developer monitors for any manufacturer updates regarding the N-content of synthetic fertilisers used by the developer, and updates annual reports accordingly.

Data/Parameter	$\mathbf{C}_{OF,\,i}$

Data unit	tN/t fertiliser
Description	N content of organic fertiliser applied in intervention area *i*
Equation(s)	(19)
Source of data	N content is determined following the fertiliser manufacturer's specifications.
Value(s) applied	Product-dependent, as indicated in the restoration plan by the developer
Quality Assurance	• The developer confirms that all information provided in the PDD is accurate. • The developer provides the name, brand and content for each chemical/fertiliser applied. • The developer indicates the N-content of the mass of chemical/fertiliser applied, which is cross-referenced with the name, brand, and content of said chemical/fertiliser provided in the restoration plan.
Quality Control	The developer monitors for any manufacturer updates regarding the N-content of synthetic fertilisers used by the developer, and updates annual reports as appropriate.

Data/Parameter	F_{SFvol}
Data unit	(kgNH3–N + NOx–N)/(kgN applied)
Description	Fraction of all synthetic nitrogen added to soils, volatilising as NH3 and NOx.
Equation(s)	(21)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11, Table 11.3 (page 24).
Value(s) applied	0.3 The IPCC applies a default value of 0.10 with an uncertainty range of 0.03 - 0.3. Due to a lack of scalable field data on a per-project basis in this version of the Quantification Methodology, Equitable Earth applies the most conservation value.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	F_{OFvol}
Data unit	(kgNH3–N + NOx–N)/(kg N applied or deposited)
Description	Fraction of all organic nitrogen added to soils, volatilising as NH3 and NOx
Equation(s)	(21)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11, Table 11.3 (page 24)
Value(s) applied	0.5 The IPCC applies a default value of 0.20 with an uncertainty range of 0.05 - 0.5. Due to a lack of scalable field data on a per-project basis in this version of the quantification methodology, Equitable Earth applies the most conservation value.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	EF_{Nv}
Data unit	kgN2O–N/(kgNH3–N + NOX–N volatilised)
Description	Emission factor for nitrous oxide emissions from atmospheric deposition of N on soils and water surfaces.
Equation(s)	(21)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11, Table 11.3 (page 24).
Value(s) applied	0.05 The IPCC applies a default value of 0.010 with an uncertainty range of 0.002 - 0.05. Due to a lack of scalable field data on a per-project basis in this version of the quantification methodology, Equitable Earth applies the most conservation value.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	F_{Fleach}
Data unit	kgN/(kg of N additions)
Description	Fraction of synthetic or organic nitrogen added to soil lost through leaching and/or runoff, where applicable.
Equation(s)	(22)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11, Table 11.3 (page 24).
Value(s) applied	0.8 The IPCC applies a default value of 0.30 with an uncertainty range of 0.1 - 0.8. Due to a lack of scalable field data on a per-project basis in this version of the methodology, Equitable Earth applies the most conservation value.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	EF_{Nl}
Data unit	tN2O-N/(tN leached and/or runoff)
Description	Emission factor for nitrous oxide emissions from N leaching and/or runoff.
Equation(s)	(22)
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11, Table 11.3 (page 24).
Value(s) applied	0.025 The IPCC applies a default value of 0.0075 with an uncertainty range of 0.0005 - 0.025. Due to a lack of scalable field data on a per-project basis in this version of the methodology, Equitable Earth applies the most conservation value.
Quality Assurance	IPCC is a reputable source approved under the Equitable Earth Programme.
Quality Control	Equitable Earth regularly checks for IPCC updates and strives to integrate any changes in new versions of the Equitable Earth Standard and/or relevant methodologies.

Data/Parameter	A_{rest}
Data unit	ha
Description	Restoration site(s) area
Equation(s)	(24)
Source of data	Developer with GIS data
Value(s) applied	Project-specific
Quality Assurance	Relevant stakeholders are consulted to determine the restoration site. The results of the consultation can be found in the Project Design Document. The restoration site(s) area is validated visually using GIS tools and satellite data.
Quality Control	Equitable Earth visually validates the restoration site(s) area using GIS tools and satellite data.

B1.2 Monitored Parameters

Data/Parameter	Hosting area i,t
Data unit	ha
Description	The known area where activity shifting leakage of activity i in year t occurs.
Source of data	Developer with GIS data
Monitoring procedures	Relevant stakeholders are consulted to get a precise understanding of the leakage activities and their areas. The results of the consultation can be found in the Project Design Document.
Monitoring frequency	Once every verification.
Quality Assurance	The hosting area is based on the leakage declaration from which is subject to verification by a VVB. The certification platform provides secure data entry.
Quality Control	A satellite imagery review from GFW images is performed to control the surface of the selected hosting area.

Data/Parameter	Forest $cover_t$
Data unit	ha

Description	Forest cover surface of the project area in year t
Source of data	Global Forest Watch (GFW)
Monitoring procedure	Forest cover loss is estimated by GFW using satellite imagery. Their model will be accessed and computed to generate alerts and/or detailed reports.
Monitoring frequency	Monthly
Quality Assurance	GFW is a reputable source approved under the Equitable Earth Programme. The model is accessed automatically via a secure API.
Quality Control	Equitable Earth must perform periodic visual validation of GFW forest cover alerts by comparing them against updated AGB maps from the Equitable Earth AGB provider. Discrepancies or false positives must be flagged and reviewed as part of the verification process.

Data/Parameter	Forest cover leakage $belt_t$
Data unit	ha
Description	Forest cover surface in the leakage belt in year t
Source of data	Global Forest Watch (GFW)
Monitoring procedure	Forest cover loss is estimated by GFW using satellite imagery. Their model will be accessed and computed to generate alerts and/or detailed reports.
Monitoring frequency	Once every verification
Quality Assurance	GFW is a reputable source approved under the Equitable Earth Programme. The model is accessed automatically via a secure API.
Quality Control	Equitable Earth must perform periodic visual validation of GFW forest cover alerts by comparing them against updated AGB maps from the Equitable Earth AGB provider. Discrepancies or false positives must be flagged and reviewed as part of the verification process.

Data/Parameter	$SE_{pixel,t}$
Data unit	tDM
Description	Standard error from the AGB provider for each pixel at year t

Source of data	AGB provider
Monitoring procedures	Standard error is provided by the AGB Provider from their models based on satellite imagery. Their results will be accessed and computed to generate detailed reports.
Monitoring frequency	Once every verification.
Quality Assurance	Refer to Quality Assurance of AGB_t.
Quality Control	A series of automated tests are performed within the pipeline to detect anomalies (e.g., impossible values). The system also produces quality statistics.

Data/Parameter	**ABG_t** *This parameter encompasses all AGB-related variables, including, but not limited to:* • **$AGB_{rest,t}$** • *AGB for loss event(s)* • *AGB in control plots* • *AGB in hosting areas*
Data unit	tDM
Description	Above-ground biomass at year t
Equation(s)	(2), (26), (27)
Source of data	AGB provider
Monitoring procedures	Above-ground woody biomass is measured by Chloris using their models based on satellite imagery. Their results will be accessed and computed to generate detailed reports.
Monitoring frequency	Once every verification, unless a significant loss event is identified.
Quality Assurance	A detailed analysis of the Chloris methodology for AGB calculations is available here. Their results are accessed automatically via a secure API.
Quality Control	A series of automated tests are performed within the pipeline to detect anomalies (e.g. impossible values). The system also produces quality statistics. A GIS analyst performs a complementary quality control. This test involves a visual review of possible artefacts such as climatic or BRDF effects and, if required, verifying data with high-resolution imagery.

Data/Parameter	P_i
Data unit	Dimensionless
Description	Declared % of displacement of the activity
Equations	(31)
Source of data	Developer in the Project Design Document
Monitoring procedures	The developer reports on the declared % of displacement of activity and justifies this percentage.
Monitoring frequency	Once every verification
Quality Assurance	Developers consult relevant local stakeholders to get a precise understanding of the leakage activities and the need to displace them. The results of the consultation are found in the Project Design Document.
Quality Control	Equitable Earth cross-checks data with the Livelihoods interventions to verify that the leakage mitigation plan corresponds to the percentage informed. The inputs are securely stored to prevent unauthorised access, tampering, or loss. A log is maintained to record errors and corrective actions taken.

Data/Parameter	$A_{burn,i}$
Data unit	ha
Description	Intervention area *i* burnt due to prescribed burning as a site preparation technique.
Equation(s)	(14), (15)
Source of data	Calculated from GIS data
Monitoring Procedure	Equitable Earth monitors the intervention area (delineated by the developers via the certification platform) via satellite imagery and GIS data to ensure the fire remains within the designated boundaries.
Monitoring Frequency	Once before intervention, right after intervention (1 day after all fires have been extinguished) and 7 days after that date.
Quality Assurance	The prescribed burn intervention area is validated visually using GIS tools and satellite data. There must be ≥95% alignment between planned vs. actual burn area.
Quality Control	Pre-burn:

	Equitable Earth validates the polygon geometry and cross-references it with the fire management plan, allocated permits (if applicable), and any officially designated fire exclusion zones (protected areas). Equitable Earth ensures the submitted burn date matches the fire management plan for any seasonal restrictions. During/post-burn: • Calculate burn severity via NDVI/dNBR (Normalised Burn Ratio) from Sentinel-2. • Use NASA's FIRMS platform to cross-check fire data. • Compare pre- and post-burn imagery to confirm spatial compliance (e.g., ≤5% deviation).

Data/Parameter	$\mathbf{AGB}_{site,i}$
Data unit	tDM/ha
Description	Above-ground biomass density at site *i*
Equation(s)	(14), (15)
Source of data	AGB provider (Chloris)
Monitoring Procedure	Above-ground woody biomass is measured using satellite imagery.
Monitoring Frequency	Once before intervention and 1 day after all fires have been extinguished, it can be extended to 7 days after, if flare-ups have been identified.
Quality Assurance	Refer to Quality Assurance of $\mathbf{AGB}_t$.
Quality Control	Refer to Quality Control of $\mathbf{AGB}_t$.

Data/Parameter	$\mathbf{M}_{SF,i}$
Data unit	t fertiliser
Description	Mass of N-containing synthetic fertiliser applied in intervention area *i*
Equation(s)	(18)
Source of data	Mass of synthetic fertiliser applied in the project, as indicated by the developer in the annual report.
Monitoring Procedure	Equitable Earth monitors the mass of synthetic fertiliser applied

	in the project area by reviewing the Annual Report and comparing it to the relevant indicators and application timeline specified in the restoration plan at the time of certification.
Monitoring Frequency	Equitable Earth monitors the mass of synthetic fertiliser applied in the project area on an annual basis via the Annual Report.
Quality Assurance	• The developer confirms the veracity of all information provided in the PDD. • The developer provides invoices for the purchase of chemicals or fertilisers. • The developer indicates the volume applied for each chemical, as well as the method and time of application, in the restoration plan.
Quality Control	Once all fertiliser has been applied, Equitable Earth cross-checks the soil sampling results against the mass of synthetic fertiliser intended for application, as specified in the restoration plan.

Data/Parameter	$\mathbf{M}_{OF,i}$
Data unit	t fertiliser
Description	Mass of N-containing organic fertiliser applied in intervention area *i*
Equation(s)	(19)
Source of data	Mass of organic fertiliser applied in the project, as indicated by the developer in the restoration plan.
Monitoring Procedure	Equitable Earth monitors the mass of organic fertiliser applied in the project by reviewing the Annual Report and comparing it to the relevant indicators and application timeline specified in the restoration plan at the time of certification.
Monitoring Frequency	Equitable Earth monitors the mass of organic fertiliser applied in the project area on an annual basis via the Annual Report.
Quality Assurance	• The developer confirms the veracity of all information provided in the Project Design Document. • The developer provides invoices for the purchase of chemicals or fertilisers. • Before applying any chemicals or fertilisers, the developer carries out soil sampling and cross-references it with scientific literature on the specific soil conditions of the project's biome/ecosystem. • The developer indicates the volume applied for each chemical, as well as the method and time of application, in the restoration plan.

Quality Control	Once all fertiliser has been applied, Equitable Earth cross-checks the soil sampling results against the mass of organic fertiliser intended for application, as specified in the restoration plan.

Appendix C: Criteria and Requirements for Intensive Site Preparation Methods

This appendix provides specific applicability criteria and requirements for projects using intensive site preparation methods. Projects must follow these criteria and requirements in addition to those set out in the *Site Preparation* section.

C1.1 Chemicals

Applicability Criteria

C1.1.1 The use of chemicals as a site preparation activity may include the following:

C1.1.1.1 **Pest Control Chemicals & Herbicides.** The use of pest control chemicals and herbicides is allowed only when the density and impact of invasive species or pests (e.g., *Brachiaria* grass, leaf-cutter ants, weeds) prevent the establishment, growth, and survival of tree species, as well as natural regeneration, and manual removal is not possible.

C1.1.1.2 **Fertilisers.** The use of fertilisers is allowed only in nutrient-poor soils where the establishment, growth, and survival of tree species, as well as natural regeneration, would not be feasible without nutrient supplementation. Developers must provide evidence that soils are nutrient-poor.

C1.1.2 For every requirement in this subsection asking for proof of soil nutrient levels or the level of chemicals, developers must provide evidence based on soil samples and scientific literature on the specific soil conditions of the project biome/ecosystem.

Requirements

Worker Safety

C1.1.3 Projects must ensure that all field workers handling chemicals receive training that addresses the potential environmental hazards and safety risks associated with this activity. The developer must provide evidence, including, but not limited to, training materials and certificates of completion.

C1.1.4 Projects must ensure that Personal Protective Equipment (PPE) is used at all times during any contact with and handling of chemicals, including during transport, storage, and application, as appropriate.

Choice of Chemicals

C1.1.5 Projects should prioritise organic fertilisers over synthetic fertilisers.

C1.1.6 Projects must provide a detailed list of all chemicals to be used for site preparation, including the following:

C1.1.6.1 Proof that said chemicals meet internationally recognised human safety standards

C1.1.6.2 Legal status for use and proof of rigorous testing of each chemical in the project jurisdiction

Application

C1.1.7 Projects must indicate the volume applied for each chemical, as well as the method and time of application.

C1.1.8 Projects must implement spot spraying or cut-stump treatments to minimise impacts on non-target species.

C1.1.9 Projects must establish buffer zones around water bodies and wetlands in the project area, maintaining at least a 30-meter no-chemical buffer zone.

C1.1.10 Projects must implement erosion control measures (e.g., mulching, contour ploughing) to prevent runoff.

C1.1.11 Fertilisers must be:

C1.1.11.1 Applied only in amounts necessary to meet specific nutrient deficiencies

C1.1.11.2 Localised around planting holes rather than sprayed in blanket distribution

C1.1.11.3 Avoided altogether in areas where native species are adapted to low-nutrient soils to prevent ecosystem imbalance.

Post-Application Safeguards

C1.1.12 Projects must monitor the levels of chemicals on targeted populations to report on the application's effectiveness. Monitoring must be conducted annually for five years following the date of the last application.

C1.1.13 Projects must assess and report on soil nutrient levels, proving that nutrient levels are not reaching potentially detrimental levels. If nutrient levels are considered too high, projects must adjust fertilisation practices accordingly. Monitoring must be conducted annually for five years following the date of the last application.

C1.1.14 Projects must monitor any contamination or signs of chemicals leaching in nearby water bodies using water samples before application, and following the next two rainfall events exceeding 20 millimetres within 24 hours, within 30 days of application. If any contamination or increase in nutrient content (e.g., nitrogen, phosphorus or potassium) has been detected in the samples, the Project must immediately halt the use of chemicals, determine whether the Project is responsible for the contamination or not, and if confirmed, implement corrective measures to remove the contamination.

C1.1.15 Projects must revegetate the soil with native or transitory regenerative species within 3 days after invasive species removal (i.e., post-herbicide application).

C1.2 Transitory Non-Native Species

Applicability Criteria

C1.2.1 The use of transitional non-native species as a site preparation activity is only allowed if:

C1.2.1.1 Baseline conditions of the restoration site(s) preclude the establishment of native species due to soil infertility, erosion, or microclimate extremes (e.g., lack of shade, temperature fluctuations), and the transitory non-native species provide critical ecosystem services (e.g., erosion control, shade provision, soil stabilisation) necessary for the establishment of native species.

C1.2.1.2 Their phased removal is planned and included in the restoration plan, in line with the requirements in the *Species Diversity* section, and implemented within the timeline set out in the restoration plan.

Requirements

Planning

C1.2.2 Projects must list all transitory non-native species to be used and describe the following:

C1.2.2.1 Their environmental benefits and ability to temporarily support the fast recovery of ecological functions and processes of the ecosystem (e.g., better soil, shadow conditions)

C1.2.2.2 Procedures and timelines for their planting and subsequent removal

C1.2.2.3 Areas where species will be planted

C1.2.3 Projects must strive to limit the number of established non-native individuals.

Post-Implementation Safeguards

C1.2.4 Projects must monitor the introduction of non-native species to ensure that they are not spreading beyond the dedicated area(s) as described in the restoration plan.

C1.2.4.1 Any transitory non-native species located outside of the dedicated area(s) must be eradicated.

C1.2.5 Projects must remove non-native transitory species from the restoration site(s) within the timeline set out in the restoration plan.

C1.3 Mechanical Intervention

Applicability Criteria

C1.3.1 Mechanical interventions[20] are permitted only:

C1.3.1.1 In areas where soil conditions (e.g., compaction, poor drainage) require mechanical treatment to enable tree establishment and growth, and where manual methods are not feasible

C1.3.1.2 As long as soil in the intervention area is not inverted to a depth greater than 25 centimetres

[20] The use of any kind of machinery or physical methods as a site preparation method.

C1.3.1.3 as long as the hydrology of the Project Area is not manipulated or impacted (e.g., by draining wetlands, pumping groundwater, or engaging in other activities that lower the water table).

Requirements

Planning

C1.3.2 Projects must provide a comprehensive description of the machinery to be used, including the intensity and frequency of the planned intervention.

C1.3.3 Projects must ensure that all field workers operating heavy machinery receive training that addresses the potential environmental hazards and safety risks associated with this activity. The developer must provide evidence, including but not limited to training materials and certificates of completion, to Equitable Earth and the VVB for review.

C1.3.4 Projects must obtain any required permits from the project jurisdiction before implementing the corresponding intervention.

Application

C1.3.5 Projects must strive to minimise soil disturbance and/or disruption by using the least invasive mechanical removal technique possible. Such techniques include, but are not limited to, the adoption of:

C1.3.5.1 Minimal tillage and strip tilling, or patch treatments, to improve soil quality. These activities should be executed selectively to avoid erosion risks.

C1.3.5.2 Scarification, subsoiling, digging, or mounding techniques that target only localised areas to minimise disturbance.

Post-Preparation Safeguards

C1.3.6 Projects must install physical barriers (e.g., silt fences, fibre rolls) in erosion-prone areas, especially on slopes ≥3%.

C1.3.7 Projects must revegetate within 3 days after the mechanical intervention and do so using appropriate species (i.e., native species or transitory species depending on soil conditions as pre-determined by soil samples), to stabilise the soil.

C1.3.8 Projects must provide a monitoring plan for erosion and compaction post-treatment.

C1.4 Prescribed Burns

Applicability Criteria

C1.4.1 Prescribed burns are allowed only:

C1.4.1.1 When no other site preparation method is suitable for controlling invasive species, or when it is necessary to reduce wildfire risks by managing vegetation loads or creating firebreaks in fire-prone areas

C1.4.1.2 In fire-adapted ecosystems, where it is essential for natural ecological processes, such as nutrient cycling and seed germination, particularly when it aligns with and upholds sustainable community practices, Indigenous knowledge, and traditional forest management

Requirements

Pre-Burn Preparation

C1.4.2 Projects must indicate the total area subject to the prescribed burn, and provide a shapefile delimiting the area(s).

C1.4.3 Projects must obtain fire permits in compliance with laws in the project's jurisdiction, if applicable.

C1.4.4 Projects must perform a detailed site assessment and report on the:

3) Planned fuel load, intensity, and frequency in each of the target sites

4) Historical fire regime of the ecosystem

5) Seasonality and weather conditions for the planned prescribed-fire activities

C1.4.5 Projects must ensure that all staff members involved in planning, executing, and monitoring the prescribed burn are trained. The developer must justify to Equitable Earth and the VVB why the training material used is adequate.

C1.4.6 Projects must register the details of all team members who will plan and execute the prescribed burn, including their contact details and certifications of training completion.

C1.4.7 Projects must provide a comprehensive Fire Management Plan including the following elements:

6) Number of intended fire-management cycles, with justification

7) Availability of PPE for each involved staff member

8) Number of staff members trained on fire management, including the certificate of training.

Implementation

C1.4.8 Projects must not conduct any prescribed burns during the dry season of the project location.

C1.4.9 Projects must ensure at least two trained individuals are present per hectare burned and at least one water unit per five hectares. Water units may include, but are not limited to, fire trucks, pick-up mounted skids, tanker trucks, fire hydrants, and on-site tanks.

C1.4.10 Projects must create firebreaks around the area intended for prescribed burning.

C1.4.11 Projects must create 15-meter-wide buffer zones around the area assigned for prescribed burning.

C1.4.12 Projects must deploy only trained fire brigades with on-site firefighting equipment during prescribed burns.

Post-Burn Safeguards

C1.4.13 Projects must ensure that any prescribed burn is completely extinguished before physically leaving the site.

C1.4.14 Projects must implement erosion control measures (e.g., mulching, fast-growing cover crops) post-burn to stabilise soils.

C1.4.15 Projects must revegetate the soil as soon as fire is completely extinguished and do so using appropriate species (i.e., native species or transitory species depending on soil conditions as pre-determined by soil samples), to stabilise the soil.

C1.4.16 Projects must monitor the site for re-ignition risks daily during the week following the intervention and for invasive species regrowth for the entire crediting period.

Appendix D: Random Plot Procedure

This appendix outlines the procedure used by Equitable Earth to randomly assign field survey plots within the restoration site(s).

D1.1.1 The K-means clustering algorithm[21] is applied to stratify the restoration site(s) into a maximum of five clusters, grouping areas with similar land characteristics (e.g., AGB level, elevation, slope profile). Historical land-cover data is used for clustering, with more recent data given greater weighting where available.

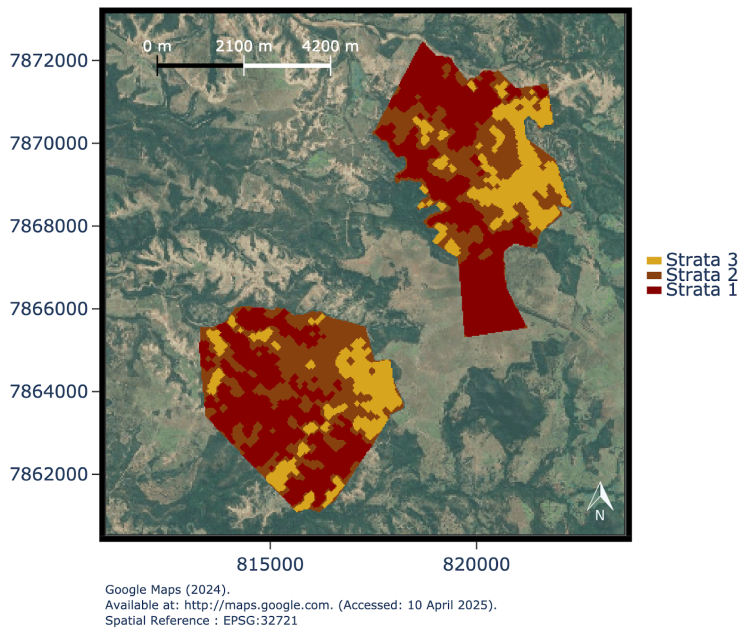

Figure 9. Stratification of the project area.

D1.1.2 The resulting strata are extracted as one or more distinct shapes, which may be spatially disaggregated depending on the area heterogeneity. A 100-meter buffer is applied around each shape to prevent overlap and ensure a minimum distance between survey plots belonging to different clusters.

[21] The K-means clustering algorithm is a common machine learning tool that groups similar data points into K distinct clusters such that points within each cluster are as similar as possible, while clusters themselves are as distinct as possible from each other.

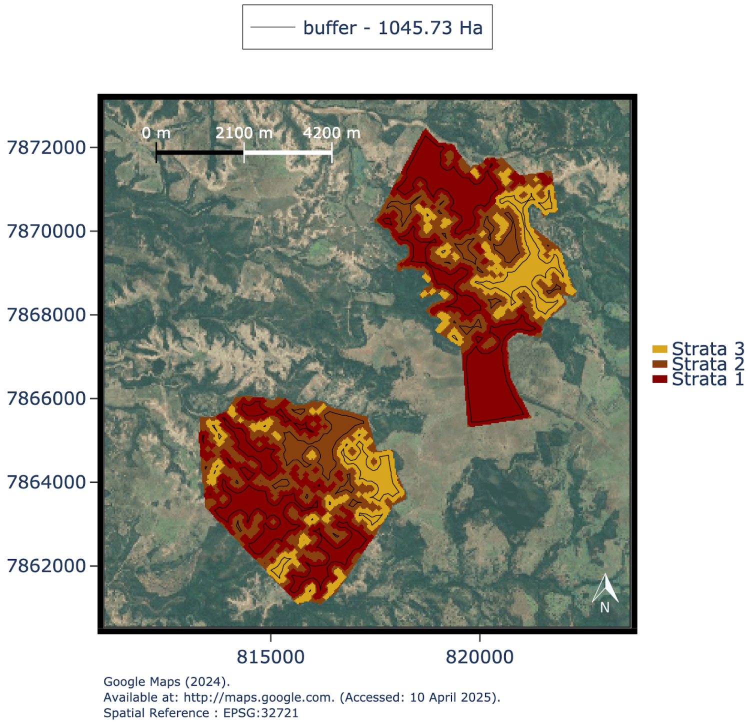

Figure 10. Stratification with a 100m buffer applied.

D1.1.3 Each shape should fall between 5 hectares and 10 hectares with a 100-meter buffer. Shapes exceeding 10 hectares are randomly split into sub-shapes until all comply with the 10-hectare upper size limit. However, if the above constraints result in too few eligible shapes, Equitable Earth may incrementally reduce:

D1.1.3.1 The minimum plot size to 1 hectare (below that threshold, the shape would be removed).

D1.1.3.2 The buffer to 10 meters.

D1.1.4 Therefore, an individual stratum is only produced if it contains at least one shape measuring 1 hectare or more after subtracting a 10 to 100-meter buffer.

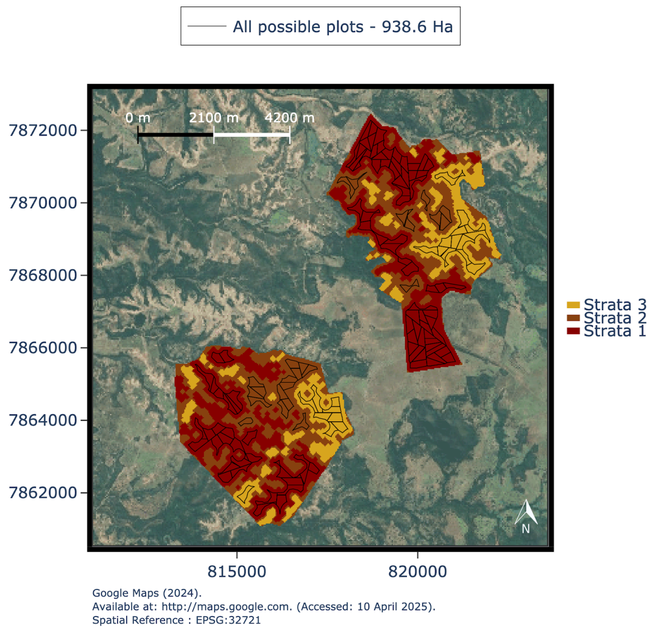

Figure 11. Sub-division into compliant plot sizes.

D1.1.5 A maximum of three survey plots per stratum are selected through a weighted random sampling method, using the following protocol.

D1.1.5.1 **First Plot Selection.** The initial plot is chosen based on probability weighted by area size (i.e., the larger the shapes, the higher the odds).

D1.1.5.2 **Subsequent Plot Selection.** Each additional plot is selected based on a composite probability weighted by both area size and distance from already selected plots, calculated with the following equation (36):

$$\mathbf{p}_i = \alpha \times \left(\frac{\mathbf{area}_i}{\sum_{j=1}^{n} \mathbf{area}}\right) + \beta \times \frac{\overline{\mathbf{distance}_i}}{\mathbf{max}_r(\overline{\mathbf{distance}_r})} \quad (36)$$

Where:

- α = Area weight score; dimensionless
- β = Distance weight score; dimensionless
- $\mathbf{area}_i$ = Size of shape i; ha

- $\overline{\textbf{distance}}_i$ = Average distance of shape i from previously selected shapes; m
- $\sum_{j=1}^{n} \textbf{area}_j$ = Size of all remaining shapes; ha
- $\textbf{max}_r(\overline{\textbf{distance}}_r)$ = Maximum average distance of all remaining shapes r to the previously selected shapes; ha

D1.1.6 **Termination.** The process stops when either three plots are selected per cluster or all eligible shapes have been evaluated.

D1.1.7 Once the survey plots have been selected, they are automatically integrated into the Equitable Earth Mobile App. Developers may then access these predefined locations to conduct their field assessments. Please refer to the *Field Assessment* section for more details.

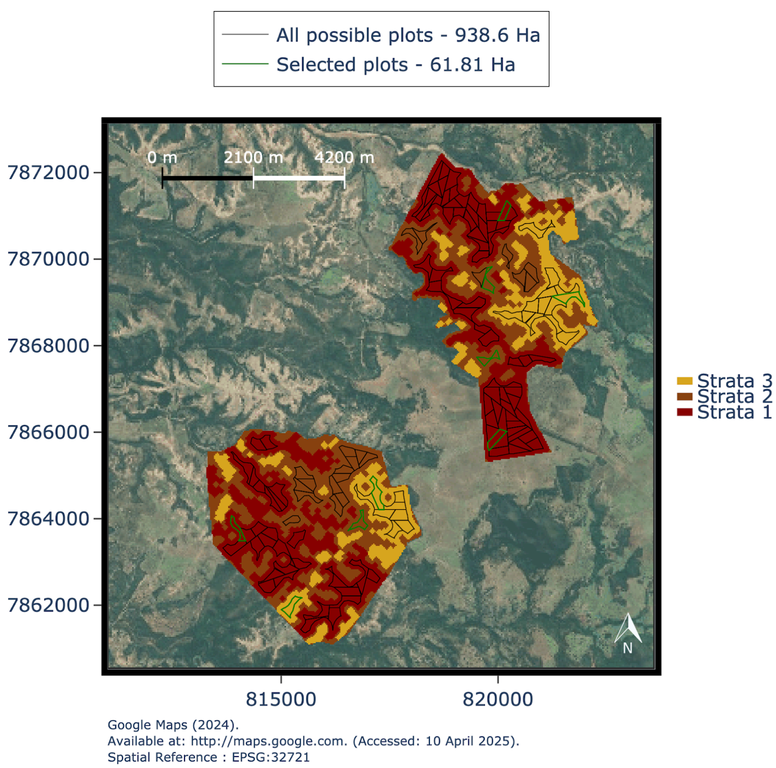

Figure 12. Selection of random plots per strata.

Appendix E: Documentation History

Version	*Date*	*Comment*
1.1	05/07/2024	Public release of version 1.1 of the *M001 - Methodology for Terrestrial Forest Restoration*
1.1	26/07/2024	Update for minor typographical revisions
1.1	28/11/2024	Updates to address the accreditation Clarification Request. Main updates include: Section '*CARBON - Leakage*' (page 26) ● clarified requirements for leakage monitoring and reporting. Section '*CARBON - Additionality*' (page 20) ● clarified principles for every barrier of the barrier analysis. Section '*Adjustment factors - Leakage*' (page 20): ● clarified requirements for leakage monitoring.
1.2	01/08/2025	Public release of version 1.2 of the *M001 - Methodology for Terrestrial Forest Restoration*. The complete list of revisions and updates to the documentation is available at the following link.

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