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## Programme & Methodology

# Future Improvements & Limitations

## Summary

This document details future improvements and limitations related to M001 - Methodology for Terrestrial Restoration and the Equitable Earth Standard. Equitable Earth is committed to continually improving and developing its methodologies.

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# 1 Introduction

## 1.1 Normative References

1.1.1 The following document should be read in conjunction with:

- M001 - Methodology for Terrestrial Forest Restoration
- Terms & Definitions

## 1.2 Reading Notes

1.2.1 The sections are divided into:

1.2.1.1 **Future improvements:** Limitations that Equitable Earth believes can be addressed with the current 'state-of-the-art' science, technology, and market practices. Equitable Earth has not yet found a way to accurately and efficiently implement these improvements into the current methodology, but is actively working towards including them in a future version.

1.2.1.2 **Limitations:** Limitations for which Equitable Earth has no short-term action plan. These often include fundamental limitations which apply to all carbon standards and for which Equitable Earth currently lacks realistic pathways for improvement without significant scientific, technological, or market breakthroughs.

# 2 Ecological Recovery

## 2.1 Future Improvements

2.1.1 **Lack of reference site(s).** Developers must submit a reference site for (1) setting the right ecological targets for the project's ecological recovery and (2) for Equitable Earth to estimate the project's carbon potential accurately. However, in some instances, due to specific geographic or ecological conditions, developers may not be able to find an accessible site within reach of the project area. Equitable Earth is exploring alternatives to accurately estimating the carbon potential of projects without a reference site, such as data sets.

2.1.2 **Climate change and reference ecosystems.** As climate change is shifting the location and composition of biomes, it would be suitable for developers to find a reference ecosystem adapted to the future climatic conditions of the project area, instead of one based on past conditions. Doing so with ecological integrity is a non-trivial task, and Equitable Earth is considering various safeguards and the implications of implementing such a requirement.

2.1.3 **Quantifying ecosystem attributes.** M001 currently lacks a methodology for quantifying and monitoring certain ecosystem attributes, such as substrate or productivity. Equitable Earth is actively exploring procedures to accurately track water, air, and soil quality in an efficient, scalable, and precise way as part of ongoing R&D efforts.

## 2.2 Limitations

2.2.1 **Challenges in quantifying and monitoring biodiversity.** A key limitation in Equitable Earth's methodology is the absence of mandated quantification and monitoring of specific biodiversity metrics. This decision stems from two key factors. First, an Equitable Earth-led public consultation revealed a lack of consensus on which biodiversity metrics should be tracked and appropriate methodologies for doing so. The diversity of ecosystems, coupled with the varying scientific opinions, makes it challenging to standardise these metrics. Second, while scientific improvements are being made to measure biodiversity, significant logistical and financial challenges remain, particularly when implementing statistically significant sampling protocols. Many of these methods, such as environmental DNA (eDNA) analysis and bioacoustics, have inherent limitations — eDNA does not provide abundance data, and

bioacoustics is restricted to species that produce sound, thereby limiting their scope. Equitable Earth will continue to track improvements and will look to implement industry-standard metrics and data collection protocols as they emerge.

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💡 Equitable Earth still encourages the use of eDNA, bioacoustics, and camera traps when these tools are available, especially for projects in which specific species are relevant indicators of ecosystem recovery. Until Equitable Earth establishes a standardised approach for using such tools, field assessments will continue to serve as the primary method of ecological and biodiversity monitoring.

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# 3 Carbon

## 3.1 Future Improvements

### Inclusions

3.1.1 **Soil Organic Carbon (SOC).** Equitable Earth acknowledges SOC's significant role as both a carbon sink and a carbon pool.

3.1.1.1 Currently, Equitable Earth excludes SOC from its carbon quantification across methodologies due to the complex nature and challenges associated with accurately measuring it at a site-specific level. The exclusion of SOC is considered net conservative, as restoration generally leads to increased SOC sequestration.

3.1.1.2 To avoid the release of unaccounted carbon equivalent emissions due to soil disturbance, Equitable Earth has established a guideline that restricts tilling deeper than 25 cm. This measure is intended to limit the depth of soil disturbance, thereby reducing the likelihood of significant carbon release from soil disruption. Moving forward, Equitable Earth aims to incorporate SOC in its GHG emission estimations, both as a source and a sink.

3.1.1.3 Equitable Earth acknowledges the site-specific nature of SOC and does not consider numbers from regional databases and the literature to be appropriate proxies for project-level SOC values. Acknowledging the technical, logistical, and financial challenges in implementing site-specific SOC measurements, such as core sampling, Equitable Earth will likely make SOC inclusion optional in a future version of M001.

3.1.2 **AGB model calibration using field data.** Field data calibration enhances model precision, particularly in heterogeneous or data-sparse regions. However, some limitations remain. Ensuring the representativeness of sample plots, aligning measurement timing with remote sensing data acquisition, and matching spatial resolutions between datasets are all critical to calibration quality. To address these challenges, Equitable Earth will continue to evaluate new data collection techniques and consider integrating more advanced calibration models as needed. These improvements are designed to strengthen further the robustness and credibility of carbon estimates across projects.

3.1.3 **Scope 1 emissions.** Equitable Earth may introduce reporting of Scope 1 project emissions, specifically fossil fuel use, in a future version of M001. The

estimated GHG emissions would be included in the reversal calculations every two years. The challenge is to create a robust and verifiable approach without overburdening developers. Note that such emissions are typically considered *de minimis* by most carbon standards.

3.1.4 **Inter-registry operations for VRU transfers.** Equitable Earth is committed to exploring opportunities for inter-registry operations that align with industry standards and regulatory requirements.

3.1.4.1 Future considerations include potential collaborations, partnerships, or regulatory changes that enable the secure and compliant transfer of Equitable Earth VRUs between registries. Equitable Earth closely follows the work done by Climate Action Data Trust and is willing to connect the Equitable Earth Registry at a more developed stage.

3.1.4.2 Equitable Earth is committed to monitoring industry developments, regulatory changes, and best practices related to inter-registry operations. The organisation is prepared to adapt its policies and procedures as needed to facilitate such operations while maintaining the highest standards of transparency and accountability.

## Methodological Improvements

3.1.5 **Uncertainty and conservativeness.** Equitable Earth acknowledges that the current approach to uncertainty and conservativeness can be potentially disadvantageous to developers. This is particularly evident in the use of the lower 70% uncertainty bound for the reference site(s) and the upper 70% uncertainty bound for the restoration site(s). While this method is highly conservative, it also presents a statistically improbable scenario. Furthermore, this approach may double-count uncertainty sources, as the calculations for the restoration and reference sites are performed independently. Equitable Earth is committed to finding a more balanced and accurate approach by exploring alternative methods for addressing uncertainty and conservativeness.

3.1.6 **Unit allocation for conservation initiatives.** The current removal-only approach does not capture avoided degradation in the control plots that would have occurred without project interventions. To fully reflect the impact of developer interventions, future versions may need to incorporate mechanisms that recognise both degradation reduction and biomass preservation efforts. With the upcoming release of a conservation methodology, Equitable Earth may enable a multi-methodology approach for projects that include both restoration and avoided deforestation and degradation activities.

3.1.7 **Representativeness of control plots.** Equitable Earth uses a dynamic baseline approach, which involves identifying control plots outside of the project area that match its characteristics, using a variety of environmental and ecological indicators. Despite improvements in the methodology, a few limitations remain:

3.1.7.1 **Consideration of deforestation drivers.** The current dynamic baseline methodology relies on regional deforestation and degradation patterns. However, it could be strengthened by incorporating detailed information on the project's local deforestation and degradation patterns and drivers. This information would enable the selection of control plots that share similar deforestation drivers, thereby improving the alignment between control plots and project conditions. While considering these drivers can significantly improve the accuracy of carbon accounting, it remains challenging due to high regional variability.

3.1.7.2 **Accessibility of shapefiles to ensure unique project areas.** The absence of systematically published shapefiles on other registries makes it difficult to exclude existing carbon projects from control plots. Equitable Earth recommends that industry accreditation bodies like ICVCM, ICROA, and CORSIA require the disclosure of such data for all active projects. Additionally, improving geographical data accessibility through platforms like CADTrust would enhance access to this information and help reduce the risk of double-counting.

3.1.7.3 **Absence of global land ownership data.** The lack of a comprehensive global land ownership database restricts Equitable Earth's ability to use this factor in control plot selection. Equitable Earth acknowledges that incorporating land ownership data could enhance baseline assessments and aims to integrate it into future methodologies as data becomes available.

3.1.8 **Projected carbon sequestration curves.** Version 1.2 of M001 introduced carbon sequestration curves to systematically estimate carbon stock growth during the crediting period. While the methods are robust and grounded in globally recognised IPCC growth rates, incorporating ecosystem-specific data could further enhance their accuracy. To address this, Equitable Earth is developing a database of region-specific growth rates and biome data to refine the carbon curve modelling and better represent potential net GHG removals.

3.1.8.1 Additionally, the current methodology does not apply to two specific climatic zones — Subtropical Humid Forest (Africa) and Subtropical Steppe (America) — due to insufficient data in the IPCC database used in the current methodology. Future updates will aim to expand

applicability by integrating new data sources that support accurate AGB growth rates in these regions.

### Benchmarking and Modelling Improvements

3.1.9 **Refining the AGB model benchmark.** The current Above-Ground Biomass (AGB) model adopted by Equitable Earth was selected through an intensive benchmarking process, focused on a 50,000-hectare site in Mozambique. The dataset, licensed from Sylvera, uses multi-scale LiDAR to achieve the most precise AGB dataset Equitable Earth has come across. Due to budget constraints, Equitable Earth could only license a single dataset. This particular dataset was chosen for its representation of tropical dry forests, a biome known for the complexities associated with AGB modelling. Equitable Earth now has access to a larger dataset, including various biomes, and will work on expanding the benchmark. The next iteration of the benchmark will include a public call for applications to encourage the participation of additional AGB providers.

3.1.10 **Benchmarking forest loss alert models.** Equitable Earth recognises the limitations of the Integrated Deforestation Alerts from Global Forest Watch for forest loss monitoring. In the short term, Equitable Earth will be conducting a comprehensive benchmark, including recently released models (including LUCA from Ctrees and a model built internally), to enhance the accuracy and reliability of forest loss assessments.

## 3.2 Limitations

### Exclusions

3.2.1 **Exclusion of litter and dead wood.** Litter and dead wood are conservatively excluded. Accurately quantifying these carbon pools is considered too costly compared to their relative significance to carbon stocks at the project scale.

3.2.2 **Exclusion of Soil Inorganic Carbon (SIC).** Soil Inorganic Carbon, while a significant carbon pool, is currently out of scope for this methodology. SIC is typically not included in ARR methodologies. Equitable Earth may consider including SIC alongside SOC if measurement protocols apply to both.

3.2.3 **Exclusion of methane as a GHG sink.** Methane emissions from forests, while a notable source of GHG, are presently excluded. This decision stems from the current lack of scientific consensus on the biophysical mechanisms of methane release in terrestrial forests and the absence of commonly accepted

protocols for efficiently calculating such emissions. Equitable Earth will look out for any developments in the scientific literature.

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💡 Equitable Earth acknowledges the broader consensus regarding the biophysical mechanisms of methane release in wetland ecosystems, including mangroves. Equitable Earth plans to include methane within the scope of future methodologies that cover such ecosystems.

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3.2.4 **Exclusion of water vapour.** In line with common practices in the carbon market, the M001 methodology does not encompass water vapour in GHG estimations. Water vapour, despite its important role as a GHG, is typically not accounted for due to its complex and variable nature.

## Carbon Estimations

3.2.5 **BGB estimation.** Equitable Earth currently estimates below-ground biomass (BGB) using the IPCC root–shoot (RS) ratio. However, this assumes a relatively constant ratio of above-ground to below-ground biomass for a given plant species or ecosystem. Although this method is widely accepted, it holds limitations due to factors like soil nutrient availability, moisture, and disturbances, which can affect the RS ratio and introduce uncertainty into BGB estimates. Equitable Earth is dedicated to exploring alternative methods to improve the accuracy and precision of BGB estimates.

3.2.6 **BGB loss.** Equitable Earth cannot accurately model BGB reversals resulting from loss events. As a result, the methodology conservatively assumes a 100% loss.

3.2.7 **Carbon fraction.** Equitable Earth currently applies a fixed carbon fraction value of 0.47 when converting biomass to carbon. This figure does not account for the potential discrepancies in values for different species. In the medium term, Equitable Earth considers adopting species-specific carbon fraction values to enhance the precision of its carbon estimations. However, the lack of documented carbon fraction values in the literature, especially for tropical species, is likely to be a limiting factor.

## Leakage

3.2.8 **Leakage estimation.** Equitable Earth quantifies leakage by monitoring displaced activity areas(s), as well as hosting areas within a five-kilometre leakage belt around the project area using satellite imagery. This spatially bounded approach enables the detection of land-use changes that may result

from the displacement of activities. However, in the case of larger projects or specific interventions, displacement may occur beyond this predefined belt. When the location of displaced activity cannot be identified with sufficient precision, it becomes difficult to determine the extent of leakage attributable to the project.

3.2.9 **Market leakage.** Equitable Earth does not include market leakage in the M001 methodology. This is due to inherent complexities in measuring the evolution of market demand or supply and establishing a causal link to project activities. Future versions of the M001 methodology may include market-based leakage, especially for projects focused on secondary forest growth or conservation. Additionally, assessing the impact of non-credited avoided emissions could help enhance the accuracy of leakage estimations.

3.2.10 **Upstream/downstream leakage.** Equitable Earth does not currently quantify the impacts of upstream and downstream leakage. Quantifying these impacts requires a comprehensive lifecycle analysis of all inputs and outputs associated with a project, which can be complex and data-intensive. In the near term, Equitable Earth aims to include Scope 1 emissions from project activities (refer to the *Inclusions* section above for more details). In the medium to long term, Equitable Earth may consider the inclusion of Scope 2 and Scope 3 emissions.

3.2.11 **Displacement factor.** The declared % of activity displacement in the displaced activity area for leakage quantification is provided by developers. The subjective nature of these estimates, combined with the variability in local contexts and the lack of standardised methodologies for such analysis, makes it challenging to objectively and accurately quantify these percentages. In the near term, Equitable Earth will continue to explore alternative methods of assessing displacement factors at the project level.

## Emissions

3.2.12 **Emissions from invasive species removal.** While invasive species removal is often an essential component of ecological restoration and may have measurable carbon impacts, the current version of M001 does not explicitly account for any GHG emissions resulting from the removal of invasive species. This approach is taken to avoid penalising developers for necessary ecological restoration work.

3.2.12.1 This exclusion reflects a recognised limitation. Equitable Earth acknowledges the need to develop more explicit procedures and criteria for determining when and how emissions or removals from invasive

species management should be included. In particular, further guidance is required to address the variability in removal methods (e.g., mechanical, chemical, or fire-based), project contexts, and species types, and to ensure that future accounting approaches are consistent, scientifically robust, and verifiable.

# 4 Livelihoods

## 4.1 Future Improvements

4.1.1 **Accessibility of certification to IPs & LCs.** One of the core goals of the Equitable Earth Programme is to empower developers and local communities. However, Equitable Earth acknowledges that some of its tools and methodologies require a certain level of technical understanding. To support users and promote higher autonomy, Equitable Earth is considering developing an Academy with institutional content that will allow self-paced training on how to design an ecosystem restoration project in line with Equitable Earth requirements, and use Equitable Earth tools effectively.

4.1.2 **Intra-community equity in benefit sharing.** Equitable Earth is currently evaluating how to enhance the equitable distribution of benefits within communities, particularly for IPs and LCs. On the one hand, Equitable Earth aims to maximise local autonomy and decision-making. On the other hand, Equitable Earth recognises the potential for disproportionate benefits to local elites and gender-biased decision-making. To address this, Equitable Earth is considering whether guidelines that acknowledge and address internal community dynamics can be implemented without overstepping local governance structures.

4.1.3 **Livelihood audits.** To increase the robustness of livelihood reporting, Equitable Earth may consider specific protocols for validation and verification of all livelihood requirements.

## 4.2 Limitations

4.2.1 **Subjectivity in livelihood indicators.** Equitable Earth acknowledges the challenges in measuring livelihood indicators that rely heavily on stakeholder perceptions, especially when dealing with qualitative indicators. Although Equitable Earth tries to reduce the subjectivity of indicators by requesting key results to be backed by evidence, there is a clear need to increase the objectivity and reliability of assessments by exploring collaborations and alternative approaches.

4.2.2 **Benefit sharing on secondary transactions.** Equitable Earth recognises the potential for secondary market transactions to generate value beyond the initial credit issuance. However, the current registry infrastructure presents

limitations in enabling a transparent and efficient mechanism to assess this additional value. Equitable Earth is therefore considering how such benefit-sharing approaches could be designed in the future, particularly to ensure fair outcomes for developers and relevant stakeholders.

Equitable Earth

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