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Methodology

Baseline Setting Module

Summary

This module describes the processes and procedures for Equitable Earth's centralised approach to baseline setting for terrestrial forest conservation projects that avoid unplanned deforestation and degradation (AUDD). The risk model uses annual, multi-provider AGB data to predict the spatial distribution of pixel-level relative biomass loss. The predicted relative-loss classes are converted into absolute biomass loss and aggregated over the project area. Historical areas, forecast under conditions representative of operational use, are used to calibrate the expected loss and account for project-scale spatial and temporal uncertainty, producing a baseline distribution from which a conservative crediting value is selected.

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1 Introduction

1.1 Normative References

This document must be read in conjunction with the latest versions of the following documents, available on the Equitable Earth website:

- Methodology for Terrestrial Forest Conservation (M002)
- Terms & Definitions
- Future Improvements & Limitations

1.2 Reading Notes

Several sections in this document are divided into the following sections:

- **Process Overview:** provides a high-level conceptual description of specific procedures, the purpose, key objectives, and main components and innovations of the approach.
- **Procedures:** outlines the specific steps taken by Equitable Earth to implement the processes.

1.3 Objective

This module outlines Equitable Earth's procedures and methods for establishing project-level baselines, in accordance with M002.

1.4 Scope & Applicability

This module applies to eligible projects using M002. Refer to the *Eligibility Criteria* section in the Methodology for Terrestrial Conservation (M002) for more details.

Equitable Earth adheres to the same requirements for the Baseline Validity Period (BVP) and Historical Reference Period (HRP) as outlined in M002. Refer to the *Baseline Validity and Re-Evaluation* section in M002 for more details.

2 Baseline Setting Approach

2.1 Overview

Equitable Earth sets baselines for AUDD[1] activities using a spatial model of predicted relative biomass loss. The approach aggregates pixel-level biomass loss predictions into cumulative relative-loss bands to determine plausible project-level baseline outcomes. A conservative baseline value is then selected from the resulting distribution of outcomes.

The core components of the baseline setting approach are:

1. **Risk estimation**: Estimating pixel-level probabilities of future relative biomass loss above defined jurisdiction-specific minimum relative-loss thresholds.
2. **Project-scale uncertainty**: Deriving a project-level distribution of plausible baseline outcomes from historical forecasts aggregated over project-sized areas.
3. **Baseline selection**: Selecting the baseline emissions value as a declared percentile of the simulated project-level distribution.

2.2 Principles

Equitable Earth's baseline setting approach is designed according to the following first principles:

Principle: Flexibility across multiple above-ground biomass (AGB) providers

- **Assumption:** AGB providers differ in their estimates of absolute stock and, to a lesser extent, in change, as well as in spatial artefacts and version stability. Baseline setting should therefore not rely on the continued availability or consistent behaviour of any single provider.
- **Rationale**: Equitable Earth uses a multi-provider consensus to construct conservative historical relative-loss data. The consensus reduces sensitivity to provider-specific biases, spatial artefacts, or version changes, and ensures that the baseline is not driven by any single AGB dataset.

[1] *Deforestation* and *Forest Degradation* are defined in M002 and the Terms & Definitions.

Principle: Conservative by construction

- **Assumption:** Baselines must be set based on conservative, robust, reproducible, and relative biomass-loss signals.
- **Rationale**: Equitable Earth applies conservative principles when constructing pixel-level relative-loss signals. Relative loss is calculated consistently across AGB providers and the consensus reflects the lowest relative-loss estimate among those available. A minimum reportable loss threshold further strengthens the risk model's robustness. Updates to individual layers can therefore be managed as revisions to the baseline-setting workflow.

Principle: Relative-loss predictions

- **Assumption:** A single predicted absolute biomass-loss value at the pixel level can describe different risk profiles. Treating these cases as equivalent creates a risk that the baseline cannot distinguish between likelihood, severity, and weak or ambiguous biomass-loss signals.
- **Rationale**: Equitable Earth models future biomass loss as a distribution of possible relative-loss outcomes rather than a single deterministic value, inherently capturing the different risk profiles facing the project.

Principle: Separation of risk and biomass components

- **Assumption:** Expected baseline emissions are a function of both future biomass loss risk and biomass stock. If forecasted loss risk and biomass stock are not maintained as separate inputs, each AGB provider update could require both components to be updated, creating unnecessary baseline instability.
- **Rationale**: Equitable Earth estimates future loss as a relative-loss probability distribution at the pixel level, capturing the likelihood and severity of potential relative biomass loss independently of the biomass stock in the project crediting area. The AGB stock layer is applied only after relative-loss outcomes are simulated, converting relative loss into absolute biomass loss and then into baseline emissions. This separation keeps the risk model stable for the BVP, while allowing the AGB stock layer to be updated transparently as AGB provider data improves or changes.

Principle: Baseline setting and monitoring symmetry with treatment of partial losses

- **Assumption:** Crediting emission reductions requires forecast biomass loss in the baseline scenario and observed loss during monitoring to be quantified using compatible definitions, thresholds, and biomass-conversion rules. However, differences in temporal references may need to apply a differentiated treatment of losses for biomass monitoring to avoid generating ECUs for pixels already showing signs of degradation.

- **Rationale**: The baseline represents the biomass loss expected in the baseline scenario, while monitoring quantifies biomass loss observed during the crediting period. In intermediate monitoring years 1–4, losses at or above the minimum relative-loss threshold are counted in full, while losses below the threshold are weighted according to the estimated probability that they represent real loss rather than measurement noise. This approach allows baseline setting and monitoring to remain methodologically consistent even though they are not directly symmetrical (i.e., the treatment of partial losses during intermediate monitoring is a conservative safeguard, rather than an identical application of the baseline accounting logic).

Principle: Validation before selection of the baseline emissions

- **Assumption:** The relevant model outputs, calibration procedures, and baseline uncertainty treatment must be empirically validated for the context in which they are applied.
- **Rationale**: Before the baseline emissions value is selected for the BVP, Equitable Earth validates predicted probabilities and project-level baseline distributions against historical outcomes. Across relevant spatial scales and landscape regimes, validation assesses whether the model correctly ranks areas by relative biomass-loss risk, whether predicted probabilities correspond to observed loss frequencies, and whether the resulting project-level baseline distributions are consistent with observed outcomes after aggregation. Refer to the *Model and Baseline Validation* section for more details.

3 Spatial Scope, Masks & Exclusions

3.1 Process Overview

Before estimating project baselines, Equitable Earth pre-processes the spatial data and establishes the boundaries of the project crediting area in accordance with the land cover eligibility requirements in M002. This section describes how those requirements are operationalised in terms of the spatial tests performed, their sequencing, and the outputs produced.

The tests and layers described in this section serve two distinct but related purposes. First, they determine the project crediting area. Second, they determine which areas contribute data used to develop and apply the risk model, as described in the *Risk Model Functionality* section. Most layers serve both purposes, but some do not; the two sets of exclusions are therefore described separately below.

For this module, the training target comprises the observed relative biomass loss labels across the jurisdiction used to train the risk model. The forecast target comprises the areas to which the trained model is applied to predict relative biomass loss for the BVP.

The project crediting area is determined by applying a spatial eligibility assessment, which consists of the following steps:

1) **Forest/non-forest mask:** The project area is classified into forest and non-forest pixels using the forest definition applied to a given jurisdiction. The resulting forest mask is assessed at the project start date and over the historical reference period in accordance with M002.
2) **Ecosystem exclusion layers:** Ecosystems and biophysical areas that are not eligible for crediting, such as mangroves, peat-dominated organic soils, and permanently inundated water bodies, are excluded from the project crediting area.
3) **Land-use exclusion layers:** Areas excluded by the applicable forest definition or land-use requirements, such as managed plantation forests, are identified using the most suitable spatial datasets identified by Equitable Earth and excluded from the project crediting area.

4) **Existing carbon projects**: All pixels located within existing carbon projects that are already registered with another carbon crediting programme,[2] are excluded from the project crediting area.

The land remaining after these steps constitutes the eligible project crediting area, against which project performance will be monitored throughout the project crediting period.

The same layers are also used to constrain the data on which the risk model operates. Areas that do not meet the forest definition or are identified by the exclusion layers are removed from the training target, preventing the model from learning biomass loss patterns from land that is ineligible for crediting. Relevant exclusions are also applied to the forecast target. The treatment of each layer is specified in the *Procedures* section.

Consistent with the baseline monitoring symmetry principle described in the *Baseline Setting Approach* section, the same layers and underlying datasets used to delineate the eligible project crediting area are applied throughout monitoring. This ensures that areas excluded from the baseline are also excluded from monitoring and cannot be incorporated into the final quantification of emission reductions attributable to the project.

While this module does not prescribe specific datasets, the layers described in this section are derived from global datasets, rely on documented methodologies, are version-controlled, and are evaluated by Equitable Earth before adoption. The specific datasets and versions applied to each project are documented in the project's GHG Baseline Report.

3.2 Forest Definition and Forest Mask

3.2.1 Forest Definition Selection

Equitable Earth determines the forest mask by identifying the appropriate forest definitions for the jurisdiction and translating the selected definition(s) into spatial rules.

Equitable Earth reviews and compiles the documented forest definitions relevant to the jurisdiction. This review includes official governmental definitions, methodological definitions submitted to the UNFCCC, operational definitions used in official national or subnational forest inventories, and definitions supported by relevant scientific and

[2] Equitable Earth uses the datasets available at the time of assessment to identify and exclude registered carbon projects in other carbon crediting programmes. The datasets and versions used are documented in the GHG Baseline Report. Equitable Earth may not be held responsible for any registered carbon project that is not identified or excluded due to limitations in the completeness or accuracy of the available datasets.

technical literature. For each definition, Equitable Earth records the source, geographic scope, publication date, and other relevant technical information.

Each definition is classified by source type, including statutory, methodological, and operational sources. Equitable Earth assesses the area to which each definition applies, the relevant forest types, thresholds for minimum area, tree height, and canopy cover, and how the definition is used in forest monitoring or inventory.

Equitable Earth applies the following procedure to select the forest definition:

1) Where the jurisdiction has an official governmental forest definition (i.e., a methodological definition formally submitted to the UNFCCC), Equitable Earth applies that definition.
2) Where no such definition is available, Equitable Earth selects, on a case-by-case basis, the definition or data source most consistently used to produce the jurisdiction's official forest inventory.
3) Where no clear official inventory standard exists, Equitable Earth selects the definition best supported by relevant scientific and technical literature, taking into account its applicability to the jurisdiction, ecosystem and area being assessed.

The selected definition is applied to the geographic area covered by its source. Where a single definition applies throughout the jurisdiction, it is used for the entire forest mask. Where different definitions apply to different parts of the jurisdiction, the corresponding definition is applied to each area. The selected definition applied to each jurisdiction, its geographic scope, and the rationale for its use are documented in the Quality Report and the GHG Baseline Report.

Where no applicable official, inventory-based, or sufficiently supported literature-based forest definition can be identified, Equitable Earth applies a definition adapted from the FAO. Under this adapted definition, forested areas are land spanning more than 0.5 hectares, with trees higher than five meters and canopy cover of more than 10%.

3.2.2 Additional Conditions of Forest Definitions

Before finalising the forest mask, Equitable Earth identifies and addresses any additional conditions in the selected forest definition. These conditions are assessed as follows:

1) **Land-use exclusions**: Where the selected definition excludes tree cover according to its use, including commercial plantations, oil palm or trees

planted for agricultural production, Equitable Earth selects and documents an appropriate land-use layer for constructing the forest mask.

2) **Stratified forest definitions**: Where the selected definition establishes different minimum-area, tree-height, or canopy-cover thresholds for different forest types, Equitable Earth selects and documents the spatial classification used to assign areas to the appropriate forest-type stratum and applies the relevant threshold within each stratum.

3) **Minimum-width criteria**: Where the selected forest definition includes a minimum-width criterion, Equitable Earth compares the threshold with the pixel resolution of the AGB product used for the assessment.

    a) Where the minimum-width threshold is greater than the AGB-product pixel resolution, strips narrower than the threshold are identified and excluded directly from the forest mask.

    b) Where the minimum-width threshold is smaller than the AGB-product pixel resolution, Equitable Earth applies a documented spatial or morphological approximation to identify likely strips below the threshold. Approximations are always selected in favour of conservativeness. The expected effect on the forest mask and the resulting limitation are documented in the jurisdiction's Quality Report.

4) **Planted vegetation and plantations**: Where the selected forest definition includes planted forest, the forest mask reflects this inclusion. Equitable Earth applies additional exclusions to the training target to exclude forest plantations. Refer to the *Land-use Exclusion Layers* section for more details.

3.3 Procedures for Spatial Exclusions

Equitable Earth implements the procedures outlined below in the sequence in which the different layers are applied. For each layer, this section describes its purpose, the rule applied, and the resulting output.

Land-cover Test

Equitable Earth performs a land-cover test by producing a spatially explicit forest/non-forest mask for the project crediting area. The mask is constructed by applying the forest definition selected for the jurisdiction, using the applicable criteria for canopy height, canopy cover, minimum area, and any additional elements

established by the definition. The land-cover test is applied to each of the 10 years preceding the project start date and used to evaluate whether the project crediting area conforms with the eligibility requirements set out for M002. Refer to the *Eligibility Criteria* section in M002 for more details.

Equitable Earth uses the forest/non-forest mask to exclude non-forest pixels from the training target at the start of the HRP and from the forecast target at the project start date to prevent the risk model from being trained on or applied to land that does not meet the forest definition.

Ecosystem Exclusion Layers

Certain ecosystems and biophysical areas are not eligible to generate ECUs under M002. Equitable Earth applies dedicated global layers to identify and exclude these areas from the project crediting area:

- **Peat-dominated organic soils:** Areas where organic soils dominate are excluded, but areas where peat occurs in a mosaic with mineral soils are not excluded.
- **Mangroves:** Areas identified as mangroves, even when they are considered forests, are excluded.
- **Permanently inundated water bodies:** Water bodies that are seasonally and permanently inundated are identified using an occurrence threshold, which is specified in the GHG Baseline Report. Areas that are permanently inundated are excluded from the project crediting area. Areas where seasonal inundation occurs remain included in the project crediting area.

Equitable Earth resamples each layer to the same grid as the forest mask. Any pixel identified in an excluded layer is removed from the crediting area, even where it meets the forest definition.

In addition to being excluded from the project crediting area, these areas are excluded from both the training and forecast targets to prevent the risk model from being biased by losses observed in ineligible ecosystems and biophysical areas.

Land-use Exclusion Layers

Monoculture plantations and forest plantations intensively managed for timber products, food, or fibre are excluded from the project crediting area, even where they meet the forest definition. Plantation areas are also excluded from the training target, since harvest cycles in intensively managed plantations produce biomass loss patterns that do not represent unplanned deforestation or degradation, and would otherwise distort the loss signals the model learns.

Existing Carbon Projects

Equitable Earth uses publicly-available information to identify and exclude from the project crediting area all the pixels within areas registered under an existing carbon project of another carbon crediting programme. These areas are also excluded from the training target, but retained in the forecast target, so that predicted loss remains spatially continuous across the jurisdiction even where crediting cannot occur.

Areas under Conservation Management

Additionally, Equitable Earth excludes areas under conservation management that are not part of existing carbon projects from the training target. This exclusion reduces the risk of training the model on outcomes that do not represent baseline scenario conditions and helps address gaps in carbon project datasets, particularly in jurisdictions where existing projects are not comprehensively mapped.

The table below summarises how each exclusion layer is treated. Exclusions from the project crediting area determine where ECU can be generated, while exclusions from the training target determine what the risk model learns from. Exclusions from the forecast target determine where the risk model produces predictions of relative biomass loss.

Spatial layers		Project crediting area	Training target	Forecast target
Forest/Non-forest mask		Mask produced and used to assess conformance with the M002 Eligibility Criteria	Excluded	Excluded
Ecosystem exclusion	Peat in a mosaic with mineral soils/Seasonal inundation	Included	Included	Included
	Other	Excluded	Excluded	Excluded
Land-use exclusion		Excluded	Excluded	Included
Existing carbon projects		Excluded	Excluded	Included
Areas under conservation management		Excluded	Excluded	Included

4 Risk Model Functionality

Equitable Earth estimates the project baseline in five stages, from observing historical biomass loss to publishing a single baseline value. The process is as follows:

1) Construction of a consensus observation of relative biomass loss from multiple AGB products
2) Development of a jurisdictional risk model that predicts the probability of relative loss for every eligible pixel
3) Aggregation of the expected biomass loss for each eligible pixel to obtain an expected project-level value of potential absolute biomass loss
4) Calibration of the expected project-level loss and characterisation of spatially correlated uncertainty to derive a probability distribution of plausible baseline outcomes
5) Selection and allocation of the selected baseline emissions value

The spatial layers described in the *Spatial Scope, Masks & Exclusions* section determine which pixels will be included in each of these stages, both as observations the model learns from (i.e., the training target) and as areas over which biomass loss predictions are produced (i.e., the forecast target). This section describes each stage in terms of its purpose, the procedures applied, and the outputs it generates.

4.1 Consensus Target Construction

4.1.1 Process Overview

The risk model learns from pixel-level observations of how much relative biomass was lost and where. These observations come from Earth Observation AGB products, the only source of wall-to-wall biomass estimates across a jurisdiction. Because these products use different methods, and are calibrated using different sets of ground plots, they vary in both the absolute biomass values reported for the same area and the changes reported between two points in time–differences that are highly relevant to baseline setting. The products are updated regularly, and revisions to calibration, methodology, or coverage may alter the signal reported by a product for a period that has already passed.

Basing the observation on a single AGB product would carry that product's behaviour directly into the baseline. The same product would supply the training level, biomass estimate, and monitoring reference. As a result, a product update unrelated to

conditions on the ground could affect both a project's baseline and its apparent performance.

Equitable Earth addresses these challenges by constructing a consensus from observations from multiple AGB products and leveraging multiple AGB providers. For each pixel, this procedure generates two complementary outputs: (i) relative biomass loss over a defined period and (ii) AGB stock at a defined point in time. The provider set may be adjusted for a defined zone or stratum where specific, traceable, independent, and applicable evidence demonstrates that a provider is not fit for purpose. Any exclusion is documented and applied consistently within the relevant risk vintage.

Relative Loss Layer

Equitable Earth constructs the observation in line with the following design choices:

1) **Relative biomass loss:** The observation is expressed as relative biomass loss, rather than as an absolute change in AGB calculated in tonnes per hectare. AGB providers are more consistent in their estimates of proportional biomass loss than absolute biomass levels. Working in relative terms reduces much of the disagreement between products.

2) **Agreement among AGB providers:** Biomass loss is recognised only where the selected available products agree that a loss occurred. Each selected AGB provider estimates relative loss over the same time period, and the consensus retains the most conservative value across the providers for each pixel. If only one product reports loss for a given pixel, that value is excluded from the observation. While this approach may omit some genuine loss, it prevents the model from being trained on disturbances that reflect the behaviour of a single product rather than actual change in the forest.

AGB Stock Layer

Equitable Earth construct the observation according to the following design choices:

1) **Pixel-level AGB stock**: For each pixel, the AGB stock at a defined point in time is calculated as the unweighted mean of the values reported by all AGB providers included in the ensemble. Equal weighting is the default because, in the absence of evidence to the contrary, there is no defensible basis for preferring one AGB provider over another. The resulting layer provides the AGB reference used for magnitude conversion.
2) **Differences among AGB products**: Differences among AGB providers are retained within the ensemble and reflected in the pixel-level mean. An AGB provider is not excluded or assigned a lower weight merely because it disagrees

with the other products, as agreement among AGB providers does not establish that the majority is correct. An AGB provider may be excluded within a defined zone or stratum only where specific, traceable, independent, and applicable evidence establishes that it is not fit for purpose there.

For each consensus, the AGB provider set, the rationale for any provider exclusions, and the input years are documented and locked for the risk vintage, allowing to trace each step to reconstruct and review the observation.

As an output, the consensus produces two types of pixel-level layers for a given jurisdiction: (i) a relative biomass loss layer between a period of time and (ii) an AGB stock layer for a defined point in time. These layer types are used in the baseline setting approach to determine the project baseline emissions, as described in the *Risk Model Development & Outputs* section.

Equitable Earth estimates uncertainty in the AGB stock at project scale from the dispersion among providers or another documented source. The resulting factor is applied to biomass losses in the baseline scenario and at monitoring.

4.1.2 Procedures

AGB Inputs & Providers

Equitable Earth assembles annual AGB estimates from multiple products available for the jurisdiction, covering two endpoints of the target periods and the years in between. The approach does not depend on a fixed number of products, and additional products can be incorporated as they become available and are evaluated as fit for purpose. Equitable Earth uses, but is not limited to using, the following AGB providers and products to produce risk maps:

AGB Provider	**Chloris Geospatial**	**Sylvera**	**Kanop**
AGB Product	Above-ground biomass stock	Above-ground biomass stock Canopy height and canopy Cover	Above-ground biomass stock Canopy height and canopy cover
Geographic Coverage	Global	Global	Global
Data Coverage Start	2000	2000	2000

Sensor(s)	Landsat 5/7/8/9 GEDI ICESat/GLAS Airborne LiDAR	Multi-scale LiDAR (ground/UAV/airborne) GEDI Landsat 5/7/8/9	Landsat-8/9 MODIS PALSAR-2 GEDI Airborne LiDAR NISAR Biomass
Spatial Resolution (m)	30	30	30

Additional metadata about the specific product(s) used for a given jurisdiction, including its version, accuracy, bias signals and distribution, are included in the jurisdiction's Quality Report, which is assessed externally according to the procedures established in the *External Independent Checks* section. Similarly, additional information about the specific product(s) used to estimate a project baseline is included in the GHG Baseline Report and GHG Monitoring Report, accordingly.

Grid Alignment

All AGB products and their layers are evaluated on a single reference grid. Where products differ in projection, pixel size, or extent, they are reprojected and resampled onto the grid before performing calculations.

Validity & Null Handling

Separate validity conditions are applied to the relative biomass loss and AGB stock outputs.

For relative biomass loss, a pixel is treated as valid only when every contributing AGB product reports a usable value at both endpoints of the target period. If a product is missing a value, the pixel is masked and does not enter the observation, which helps keep the consensus from being computed on a different set of products from one pixel to the next. The result is a validity mask that is retained and carried through model training.

For the AGB stock layer, a pixel is treated as valid only where every AGB provider included for the relevant zone or stratum reports a usable value for the applicable reference year. If any included AGB provider is missing a value, the pixel is masked rather than calculating the mean from a reduced provider set.

Separate validity masks are retained for the relative biomass loss and AGB stock layers and carried through the subsequent calculations.

AGB Provider-level Relative Loss

Relative loss is calculated on the eligible pixels for each AGB product independently between the start and end of the target period as the share of the starting biomass that is no longer present at the end of the period. When biomass increases, this is carried through as negative values and not set to zero. By retaining biomass gains as negative values, a product reporting growth can hold down the consensus for that pixel at the next step.

For each eligible pixel, the consensus value is the lowest relative-loss value reported by any of the contributing AGB products. Where products disagree, the consensus follows conservativeness and uses the product that saw the least loss. A pixel is only recorded as having lost a given share of its biomass where every product supports at least that much loss.

Pixel-level AGB Stock

For each valid pixel and reference year, the AGB stock value is calculated as the unweighted arithmetic mean of the values reported by all AGB providers included in the ensemble for that pixel.

Outputs & Traceability

The final outputs are the consensus relative loss layer for the target period, AGB stock layer for the applicable reference year, the corresponding validity mask, and a metadata record. The metadata record, documented in the jurisdiction's Quality Report, specifies the AGB products used and their versions, the input years and source layers, the resampling applied, the reference grid, the validity rule, and the consensus rule. This record is maintained throughout the risk vintage, allowing the reproduction and the independent review of the observation underlying a published baseline.

4.2 Risk Model Development & Outputs

4.2.1 Additional Risk Model Inputs

Equitable Earth uses primarily the raw AGB rasters as the main inputs to the risk model and the relative-loss consensus as target. Additional variables may be considered where they may provide information that is not directly recoverable from the AGB field, particularly information about environmental conditions, anthropogenic threats, or processes that may influence future biomass loss.

Candidate Model Inputs

Equitable Earth evaluates the candidate inputs for each jurisdiction established in the following table.

Candidate Input	Description & Examples of Inputs[3]
Terrain	Digital elevation model (DEM), slope, aspect, drainage
Canopy height and vertical structure	Canopy height layers, vertical forest structure metrics
Climate and seasonality	Precipitation, dry-season length, fire-weather indicators
Active fire and burned-area series	Active fire detection series, historical burned-area boundaries
Soil and agricultural suitability	Soil properties, crop suitability indices
Settlement and built-up surface	Satellite-derived measures of settlement, built-up areas, infrastructure footprints
Population density and distance to population centres	Gridded population estimates, distance to urban centres
Tenure, protected status and concessions	Boundaries for protected areas, land tenure categories, Indigenous territories, resource concessions

Evaluation of Additional Model Inputs

For each jurisdiction, the candidate inputs listed above are assessed systematically against the version of the risk model that uses only AGB rasters as predictors. The assessment uses the data, spatial coverage and processing methods that would be available for operational implementation in that jurisdiction against the following criteria:

[3] Equitable Earth provides these examples to illustrate the principal types of additional inputs that may be considered. The relevance and suitability of specific inputs are assessed on a case-by-case basis for each jurisdiction, and are documented in the Quality Report and the GHG Baseline Report.

1) **Demonstrated non-redundancy**: The candidate input must produce a measurable improvement over the AGB-only risk model on the held-out observations. Performance is assessed separately at each cumulative ordinal threshold used by the model, with particular attention to the lower thresholds that are most relevant to the application, rather than relying only on an aggregate accuracy measure or headline (e.g., R^2).

2) **Coverage of the full training window:** For time-varying candidate inputs, the historical series of the candidate input must cover the complete training period.

3) **Scalability across the jurisdiction**: The candidate input must be available with consistent quality across the entire jurisdiction.

4) **Operational producibility at inference**: The candidate input must be capable of being generated or accessed for both the HRP and the crediting period.

5) **Stationary encoding**: The candidate input must represent the same concept in the training epochs and in the prediction epoch. Changes in the underlying source, classification or processing method must not alter the meaning of the variable over time.

Equitable earth selects candidate inputs for a jurisdiction only when it satisfies all five criteria. The candidate inputs are documented in the Quality Report and GHG Baseline Report.

4.2.2 From Consensus Observations to Pixel-Level Risk

Risk Model Outputs

Equitable Earth builds a risk model using the observations provided by the consensus and additional inputs to produce, for each pixel of the jurisdiction, a set of probabilities of exceeding a set of cumulative, jurisdiction-specific, relative-loss thresholds, starting from the minimum reportable relative loss for the jurisdiction. Refer to the *Minimum Reportable Relative Loss* section for more details.

These bands are produced through a monotonic ordinal architecture (i.e., the model estimates the probability that a pixel will exceed each ordered relative-loss threshold). By design, this approach ensures that the probability of exceeding a higher threshold cannot be greater than the probability of exceeding a lower threshold. For example, the probability of losing at least 70% of biomass cannot be greater than the probability of losing at least 50%.

Minimum Reportable Relative Loss

Equitable Earth determines for each jurisdiction a minimum relative loss threshold which corresponds to the minimum relative loss that the risk model can confidently predict.

To determine this value, Equitable Earth evaluates a range of candidate relative-loss thresholds using two complementary estimators of measurement noise.

Before calculating the estimators, Equitable Earth defines two reference populations:

1) A noise population consisting of forest pixels where canopy cover and height remain stable and no disturbance event has been recorded according to sources independent of the consensus. Losses measured in these pixels are treated as noise because they have no identified physical counterpart.

2) A confirmed-loss population consisting of forest pixels where a disturbance event has been recorded according to sources independent of the consensus.

The first estimator assesses whether reported losses remain stable when the label window changes. For a given minimum relative-loss candidate, Equitable Earth recalculates the relative loss of all pixels above the threshold twice: first by moving the start year one year earlier, and then by moving the end year one year later. A physical loss is expected to remain detectable under both changes. Equitable Earth measures how often the recalculated loss decreases beyond a defined tolerance, which is set out in the Quality Report, and compares this rate with the two reference populations. The position of the observed rate between these references provides an estimate of the share of noise at each candidate threshold.

The second estimator measures false losses directly. Within specific initial-biomass bands, Equitable Earth measures how often the consensus reports a loss at the candidate threshold in the noise population. This rate is applied to all eligible pixels in the jurisdiction in the corresponding biomass band. The final output is an estimate of the number of false losses expected across the jurisdiction.

Equitable Earth defines, for each jurisdiction, the selection parameters and decision rule used to consider both estimators and determine the minimum reportable relative loss. The complete analysis, methodology and results are documented in the jurisdiction’s Quality Report.

Robustness of Risk Decomposition

Equitable Earth uses this approach to capture the wide range of possible outcomes for each pixel of the jurisdiction.

A model trained to predict a single expected loss value tends to propose a solution averaged across possible outcomes. Equitable Earth mitigates this by evaluating the prediction risk across the full severity scale, distinguishing between frequent low-severity loss, rare high-severity loss, and intermediate outcomes, and explicitly captures the upper tail of relative loss. The highest relative-loss classes may represent only a small share of pixels, yet they can account for a large share of potential emissions.

4.2.3 Selection of Historical Held-Out Observations

Equitable Earth determines a set of historical held-out observations to evaluate and, where necessary, recalibrate the probability assigned to each relative biomass loss threshold.

Equitable Earth selects the held-out observations through a spatial split of the jurisdiction. The jurisdiction is divided into spatial tiles, which are randomly assigned to either the training set or the held-out set.

Following the spatial split, Equitable Earth stratifies the evaluation of the held-out observations using relevant categories of variation defined in the Quality Report. These categories include but are not limited to:

- Historical disturbance level
- Disturbance severity
- Predicted risk level
- Landscape context (e.g., agriculture frontier, distance to road, and/or relatively undisturbed areas)
- Ecological or administrative sub-regions

Equitable Earth uses the stratification to assess whether model calibration and prediction errors differ across the conditions in which the model will be applied. Refer to the *Model and Baseline Validation* section for more details.

4.3 From Risk Modelling to Baseline Setting

To convert the risk model outputs into a project-level distribution of potential absolute biomass loss over the BVP, Equitable Earth converts the expected

project-level loss into a distribution of plausible outcomes using the empirical behaviour of historical forecasts over comparable project-sized areas.

4.3.1 Conversion to Absolute Biomass Loss

For every eligible pixel in the project crediting area, Equitable Earth converts the probability distribution of relative AGB loss into a corresponding probability distribution of absolute biomass loss.

For a pixel i, each possible relative-loss outcome is multiplied by the starting AGB stock of the pixel and the corresponding probability to determine the corresponding amount of absolute biomass loss expected, as follows:

$$BL_i = B_i \times \sum_{k=1}^{n} (p_{i,k} - p_{i,k+1}) \times L_k \quad \textbf{(E.1)}$$

Where:

- BL_i = Expected absolute biomass loss of pixel i; tDM
- B_i = Starting biomass of pixel i; tDM
- $p_{i,k}$ = Probability that the relative loss of pixel i reaches or exceeds the lower threshold of band k; dimensionless
- $p_{i,k} - p_{i,k+1}$ = Probability that the relative loss of pixel i falls within band k (i.e., threshold k, threshold k+1); dimensionless
- $p_{i,n+1}$ = 0, by construction: relative loss cannot exceed 1 (total loss), the upper bound of the last band
- L_k = Relative loss assigned to band k, taken as the midpoint of the band; dimensionless

4.3.2 Historical Reference Distribution

The expected project biomass loss does not, by itself, describe the range of outcomes that may occur over the BVP. Actual biomass loss may be lower or higher than the expected value because the risk model cannot predict the precise location, timing and magnitude of all future disturbances. The risk model may therefore overpredict or underpredict biomass loss across a substantial part of a project at the same time.

For this reason, uncertainty is evaluated directly at spatial scales representative of the project. Equitable Earth constructs a historical reference distribution by

comparing historical predictions with observed biomass loss after both have been aggregated over suitable project-sized areas.

The historical reference distribution describes the empirical variation of observed project-scale outcomes around their corresponding expected biomass-loss predictions. It provides the basis for determining the width and shape of the uncertainty distribution applied to the project and is selected following the procedures described below.

Selection of the Historical References

Equitable Earth constructs a set of historical reference areas that meet the same eligibility criteria as project crediting areas and represent the baseline scenario. Equitable Earth selects the areas most similar to the project, considering by default:

- Area size
- Predicted relative-loss rate

Additional similarity categories may be used where they are shown to improve the end-to-end validation for the jurisdiction. Candidates include, but are not limited to:

- Historical disturbance level
- Disturbance severity
- Landscape context (e.g., agriculture frontier, distance to road, relatively undisturbed areas)
- Ecological or administrative sub-regions

The categories applied, their tolerances and the resulting number of reference areas are documented in the Quality Report.

Where no comparable areas of project size exist, the distribution may be extrapolated from smaller areas. Where comparable areas are insufficient, the similarity criteria are relaxed and, if needed, a documented rule that is conservative relative to the standard case is applied and documented in the Quality Report.

For each suitable historical area, the difference between the observed outcome and the expected prediction provides one empirical observation of project-scale forecast behaviour. This difference may be expressed in absolute, relative, or standardised terms, according to the form used to transfer the uncertainty to the project.

Equitable Earth repeats this comparison across all the selected historical reference areas to produce an historical reference distribution. Its centre describes any

systematic difference between predicted and observed outcomes, while its width and shape describe the variation of project-scale outcomes around that centre. Because these differences are measured after aggregation over areas representative of project scale, the distribution captures the effect of prediction errors that occur together across neighbouring pixels. No separate spatial-dependence estimator or spatial-uncertainty adjustment is applied.

Calibration of the Distribution

Equitable Earth evaluates whether the expected biomass losses forecast by the risk model are systematically higher or lower than the corresponding observed outcomes.

Where the historical evidence shows a consistent difference, Equitable Earth calibrates the expected prediction accordingly. Where supported by sufficient historical evidence, the calibration relationship may vary with relevant characteristics such as expected loss, area size, risk level or landscape context. Following calibration, the reference distribution is centred on the calibrated expected outcome. The remaining variation around that centre represents uncertainty rather than systematic bias.

Temporal Stability

Equitable Earth evaluates whether the historical reference distribution remains stable when the risk model is applied to different historical periods.

Relationships between predicted risk and observed biomass loss may change over time. Changes in political or regulatory conditions, economic pressures, infrastructure, accessibility or other drivers of deforestation and degradation may alter both the overall amount and spatial distribution of forest loss.

Where historical forecasts from multiple periods are available, Equitable Earth compares their aggregate performance. This comparison considers whether the relationship between expected and observed biomass loss changes materially between periods and whether the spread of project-scale outcomes remains similar.

Where forecast performance changes significantly between periods, the historical reference distribution is adjusted to reflect this additional source of uncertainty. Materiality is assessed through the end-to-end validation across historical periods. Refer to the *End-to-End Validation* section for additional details.

4.3.3 Project-Level Uncertainty

Once the historical reference distribution has been constructed and calibrated, Equitable Earth applies it to the expected biomass loss calculated for the project in the *Conversion to Absolute Biomass Loss* section.

Each value of the historical reference distribution is applied to the expected project biomass loss in the same form in which it was calculated (e.g., as a ratio of observed to predicted loss). The centre of the project's biomass loss distribution therefore represents the calibrated expected loss.

The final output is a probability distribution of aggregate project biomass loss over the BVP. Its centre reflects the calibrated expected loss, while its width and shape represent the uncertainty demonstrated by historical forecast performance at spatial scales relevant to the project. This distribution is converted to emissions and combined with the other terms of the emission reduction calculation in the *Monte Carlo Simulation* section in M002.

Uncertainty in the AGB stock is estimated at project scale from the dispersion among providers or another documented source, and is applied as a factor common to baseline and monitored losses.

4.4 Baseline Publication & Allocation

The following procedures define how Equitable Earth selects one value from the project-level distribution derived from the risk model and allocates it across the BVP.

4.4.1 Crediting Percentile Selection

Equitable Earth determines the project baseline value by selecting a conservative crediting percentile from the project-level distribution defined at the 40th percentile, rather than using the central estimate by default.

This crediting percentile provides a balanced approach that recognises project impact while selecting a conservative value of the distribution. Its selection is supported by empirical testing and sensitivity analyses, including tests of performance across different scenarios.

This crediting percentile is applied consistently across projects to ensure predictable and comparable baseline setting.

4.4.2 Temporal Distribution within the BVP

The published baseline emissions value represents the total biomass loss due to deforestation and degradation for the project crediting area over the BVP. For temporal allocation, Equitable Earth retains an even split for allocation, where the total published baseline value for the BVP is divided equally across the years of the BVP.[4]

4.5 Vintages, Validity & Recalculation

Equitable Earth separates the baseline into two versioned artefacts: a risk vintage and an AGB stock layer. This architecture allows to keep the structure of risk stable for the BVP, while allowing the AGB information to be updated when AGB providers update their product.

4.5.1 Risk Vintage Validity

The risk vintage remains stable for the duration of the BVP. During this period, Equitable Earth locks the output of the risk model.

The Quality Report records the methodological and technical components of the risk vintage, including, but not limited to, the consensus composition, model version, calibration approach, and validation results.

This approach brings stability to the risk vintage by preventing frequent updates due to changes in AGB products. However, changes of risk vintage may still occur. In such cases, the change will be linked to a defined update of the conversion artefact or to an explicitly documented improvements to the model.

4.5.2 AGB Stock Layer Updates

The AGB providers selected in the consensus regularly update their products, which means that the AGB stock layer may be updated during the BVP. When such an update occurs, the standing biomass associated with the eligible pixels in the project crediting area may change even though the relative-risk structure remains the same.

Where an AGB product update affects the declared AGB stock layer used for the baseline allocation, Equitable Earth recalculates the baseline emissions using an updated AGB stock layer. The locked risk vintage is retained, but the selected relative-loss outcome is applied to the updated AGB stock layer, rebuilt on updated

[4] Equitable Earth may evaluate alternative methods for allocating baseline loss across the BVP in future methodology revisions. Refer to the Future Improvements and Limitations document for more details.

and available AGB product for the project crediting area. By doing so, the risk model is not re-established each time an AGB product is updated. Instead, the same risk vintage is re-expressed against the updated AGB stock layer.

The AGB stock layer may be derived from temporally smoothed provider series. Baseline and monitored losses are always converted using the same AGB stock layer, which is fixed at the project start date and replaced for both if updated.

5 Model and Baseline Validation

Equitable Earth applies a set of validation safeguards before the baseline is published and used for crediting. These safeguards are designed to test the baseline-setting workflow at several levels: the predictive performance of the relative-loss model, the project-level result across spatial scales, the consistency of the result with the jurisdictional context, and the reliability of the full project-level distribution. To do so, Equitable Earth implements the following procedures:

- **Relative-loss model validation**: The risk model is assessed to determine whether it produces reliable predictions of relative loss under fully out-of-sample conditions.
- **Multi-scale validation**: The plausibility of model outputs and project baseline are evaluated across relevant spatial scales, from pixel-level to project-relevant size.
- **Jurisdictional Reference Level (JRL) diagnostic comparison**: The JRL is used as a statistical benchmark. Significant exceedances or divergences are flagged, reviewed, and explained.
- **End-to-end validation**: The full baseline-setting workflow is replayed on historical hold-out areas to determine whether observed aggregate outcomes fall within the project-level distributions produced by the baseline-setting workflow.
- **External technical evaluation**: An additional independent assessment of all the components of the risk model, uncertainty treatment, and baseline-setting workflow is performed.

Together, these safeguards validate the three main elements:

1) The model produces a defensible relative-loss signal
2) The project baseline is realistic in its spatial and jurisdictional context
3) The complete risk model and baseline-setting workflow produces a reliable distribution of potential baseline emissions outcomes

5.1 Relative-Loss Model Validation

Equitable Earth validates the raw outputs of the risk model before it is used for baseline-setting to confirm that the risk model produces reliable estimates of relative loss.

Model validation is based on a fully out-of-sample spatial split. Training and validation areas are spatially separated so that the model is tested on locations it has not seen during fitting.

A valid model must demonstrate that its outputs contain a predictive signal across the relative-loss scale. Concretely, Equitable Earth is not checking that each pixel is predicted correctly as a deterministic event, but assesses whether, across many held-out observations, the model performs correctly on dimensions including, but not limited to, the following:

- **Predictive ranking**: Areas assigned higher probabilities of relative loss should experience higher observed loss frequencies than areas assigned lower probabilities.
- **Probability calibration**: For each relative biomass loss threshold, predicted probabilities should correspond to observed frequencies in held-out observations.
- **Severity resolution**: The model distinguishes low-, medium-, and high-severity relative-loss outcomes, including the upper tail of the loss distribution.
- **Independent reference comparison**: Where suitable external datasets are available for the jurisdiction, predicted loss classes or probabilities should be consistent with independent disturbance evidence (e.g., The European Commission Joint Research Centre's (JRC) degradation and deforestation classes).

5.2 Multi-scale Validation & JRL Comparison

Equitable Earth applies additional validation checks to assess whether the baseline result is credible across spatial scales and the applicable jurisdictional context.

5.2.1 Multi-scale Validation

The multi-scale validation consists of evaluating whether the risk model output remains credible when assessed at spatial scales relevant to baseline setting, including at the pixel level, intermediate aggregation scales, and project-relevant extents.

The main objective of this procedure is to confirm that the predictions made by the risk model are not only performing well on isolated pixels, but remain meaningful when aggregated to the scales at which baselines are produced.

5.2.2 JRL Statistical Comparison

Equitable Earth compares the baseline-setting workflow output against a jurisdiction reference level (JRL) to assess whether the result is plausible in the jurisdictional context.

The JRL is a jurisdiction-wide estimate of the emissions generated by forest biomass loss during the HRP. To calculate it, Equitable Earth identifies all eligible pixels that were forested at the beginning of the HRP and compares their AGB stock values at the beginning and end of the period. These pixel-level biomass losses are aggregated and converted to emissions. Uncertainty in the biomass loss estimates is propagated through Monte Carlo simulation, producing a distribution of plausible emissions for the jurisdiction.

Equitable Earth uses this distribution as a statistical benchmark to compare whether the project baseline is significantly inconsistent with the JRL and whether any divergence can be explained by the project's location, disturbance regime, or modelled risk profile. The JRL diagnostic does not trigger automatic rescaling. Equitable Earth documents all the findings on the statistical comparison in the jurisdiction's Quality Report.

5.3 End-to-End Validation

Before a project baseline is published, Equitable Earth tests the complete baseline-setting approach on historical validation areas for which the outcome is already known. Validation areas are distinct from the reference areas used to calibrate the distribution, and meet the same eligibility and baseline scenario criteria. The workflow is rerun from the start of a historical validation period, under conditions representative of project baseline setting using, where possible, only information that was available at the start of that period. For each validation area, Equitable Earth compares the project-level distribution that the workflow would have produced with the biomass loss observed over the historical validation period, quantified in the same way as the outcomes of the historical reference areas.

The primary criterion is the frequency with which observed outcomes fall below the crediting percentile, as it determines the risk of over-crediting. Equitable Earth also

assesses the ranks of observed outcomes within their distributions, lower- and upper-tail exceedances, and overall distributional calibration, across project sizes, risk levels, and relevant contexts. Where forecasts from several historical periods are available, the validation is repeated for each period; significant differences between periods are reflected in the historical reference distribution. Refer to the *Temporal Stability* section for additional details.

Acceptance thresholds used to determine the significance of differences between the forecast and observed results are defined for each jurisdiction in the Quality Report. Because the number of comparable areas is limited, especially for large projects, and overlapping areas are not independent, the sampling margin of the crediting percentile and the effective number of independent validation areas are reported alongside the results.

The baseline-setting approach passes end-to-end validation only where observed outcomes are consistent with the distributions produced. Where inconsistencies are identified (e.g., outcomes repeatedly fall below the lower tail or above the upper tail), Equitable Earth reviews the relevant upstream components or applies a documented conservative adjustment before the baseline is finalised for publication.

5.4 External Independent Assessment

Equitable Earth jurisdictional risk maps, together with the underlying baseline model and accompanying Quality Report, are assessed by third-party, independent experts. The scope of the assessment includes the following:

1) Assessment of the plausibility and accuracy of the AGB input data
2) Benchmark of the risk map and baseline against external reference datasets (e.g., UNFCCC FREL/FRL submissions)
3) Confirmation that the risk map was generated in accordance with the requirements and procedures established in M002 and the Baseline Setting Module
4) Inspection of the map for coding artefacts, edge effects, or spatial anomalies

The assessment cycle consists of a review period, a clarification round, and final report delivery. The outputs of the assessment include the following:

1) An assessment report for external publication
2) A standardised findings summary for inclusion in the Quality Report, following a fixed structure incorporating:

a) Scope

b) Overall determination

c) Key findings

d) Material issues

e) An explicit statement of conformance

f) Reviewer independence statement

To preserve independence and comparability while avoiding over-familiarity, reviewers are drawn from a shortlist of pre-qualified entities, with no entity assessing the same jurisdictional risk map for more than two consecutive cycles.

Equitable Earth's tiered assessment approach, including third-party validation of the Baseline Setting Module, expert panel assessment of jurisdictional risk maps, and periodic reviews of model updates and improvements, is forthcoming.

Appendix A: Documentation History

Table A: Document version history.

Version	Date	Description
v1.0	18/12/2025	Public release of version 1.0 of the Baseline Setting Module
v1.0.1	31/03/2026	Minor corrections and revisions to align with the latest version of the M002 methodology
v1.1	25/11/2026	Revisions to baseline-setting procedures to incorporate multi-AGB provider consensus, jurisdiction-specific modelling of relative-loss probabilities, separation of the risk vintage and AGB stock layer, and project-level calibration and uncertainty estimation from historical forecast performance.



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