CLIMATE FORWARD

Mature Forest Management Forecast Methodology

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A program of the CLIMATE ACTION RESERVE

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Abbreviations and Acronyms

AP	Assessor Parcel
C	Carbon
CARIT	Climate Action Reserve Inventory Tool
CO_2	Carbon dioxide
CH_4	Methane
EVT	Existing Vegetation Type
FIA	USFS Forest Inventory and Analysis[1]
FMU	Forecasted Mitigation Unit
FPP	Climate Action Reserve's Forest Project Protocol
FRAP	CAL FIRE Fire and Resource Assessment Program
GHG	Greenhouse gas
GIS	Geographic Information System
ISO	International Organization for Standardization
MFM	Mature Forest Management
N_2O	Nitrous oxide
PIR	Project Implementation Report
Reserve	Climate Action Reserve
SSR	Source, sink, and reservoir
SIM	Standardized Inventory Methodology
t	Metric ton (or tonne)
USFS	United States Forest Service

[1] http://fia.fs.fed.us/program-features/rpa/

1 Introduction

The Climate Action Reserve (Reserve) is an environmental nonprofit organization that promotes and fosters the reduction of greenhouse gas (GHG) emissions through credible market-based policies and solutions. Based in Los Angeles, the Reserve is the foremost carbon offset registry in North America with internationally recognized expertise in project-level GHG accounting. The Reserve establishes regulatory-quality standards for the development and quantification of GHG emission reduction projects; issues GHG emission reduction credits for use in compliance and voluntary carbon programs; and tracks the transaction of credits over time in transparent, publicly-accessible systems. Adherence to the Reserve's standards ensures that emission reductions associated with projects are real, permanent, and additional, thereby instilling confidence in the environmental benefit, credibility, and efficiency of carbon markets.

Climate Forward, a greenhouse gas mitigation program of the Climate Action Reserve, provides a practical solution to companies and organizations seeking cost-effective mitigation of anticipated (i.e., future) operational and/or project-related GHG emissions. Climate Forward facilitates investments in GHG reduction[2] activities that are practical, scientifically-sound, transparent, and aligned with forward-looking mitigation needs such as the California Environmental Quality Act (CEQA). Climate Forward will drive forward-looking investment into actions expected to result in GHG reductions, with a goal of expanding the scope and scale of feasible emission reduction project types.

Climate Forward is designed to provide companies, organizations, developers, and other entities with a conservative, robust, and methodologically rigorous option to mitigate an estimate of expected GHG emissions, on a voluntary or compliance basis, using FMUs generated from mitigation projects under this program. Climate Forward fundamentally differs from existing carbon credit programs through its focus on projecting and crediting estimated emission reductions on an *ex ante* basis. Under Climate Forward, estimated GHG reductions from the mitigation project are recognized as Forecasted Mitigation Units (FMUs), which are each equal to one metric ton of carbon dioxide equivalent (CO_2e) expected to be reduced or sequestered. FMUs can be retired for multiple purposes, including for CEQA mitigation or for other voluntary mitigation purposes.

The Mature Forest Management (MFM) Forecast Methodology provides guidance to account for, report, and confirm forecasted (i.e., *ex ante*) greenhouse gas (GHG) emission reductions associated with sequestering carbon on forestland as described in this methodology. Project proponents that initiate MFM projects use this document to quantify and register forecasted GHG reductions with Climate Forward on an *ex ante* basis. The methodology provides eligibility rules and methods to calculate expected reductions, performance-monitoring instructions, and procedures for reporting project information to the Climate Forward. Supporting information related to the calculation of carbon stocks is provided in Appendix A. Additionally, a Project Implementation Report will receive independent confirmation by a Reserve-approved confirmation body selected by the project proponent. Guidance for confirmation bodies to confirm project implementation and FMU estimates is provided in the Climate Forward Program Manual, the Climate Forward Confirmation Manual, and Section 8 of this methodology.

[2] Throughout this document, the term "reduction" is intended to address both GHG emission reductions that are the result of activities designed to reduce or avoid emissions, and GHG removals, which are those activities aimed at removing atmospheric CO_2 at rates that exceed "business as usual" sequestration.

This methodology is designed to ensure the complete, consistent, transparent, accurate, and conservative *ex ante* quantification and confirmation of GHG emission reductions associated with MFM projects.[3]

[3] See the WRI/WBCSD GHG Protocol for Project Accounting (Part I, Chapter 4) for a description of GHG reduction project accounting principles.

2 The GHG Reduction Project

2.1 Project Definition

An MFM project involves management activities that maintain and increase carbon stocks on forested land relative to baseline levels of carbon stocks through actions that focus on the development of stand structure characterized by an increased component of older and larger trees during harvest events, with increased basal area retention as is appropriate for the project area's growth capacity over time.

All MFM projects are required to be secured with a conservation easement granted to, and held by, an eligible land trust[4] that permanently dedicates the project area to forest use. The conservation easement must grant authority to the eligible land trust to monitor and enforce the restrictions contained within it. The terms of the conservation easement shall also do the following:

- Include a statement in the recitals indicating the easement is perpetual;
- Include a statement indicating that the easement is granted pursuant to the state enabling statute for conservation easements for the state in which the project is located (e.g., California Civil Code Section 815);
- Support the project activity, including but not limited to the following harvest-related activities on lands subject to timber harvest:
    - Requiring the submission of a timber harvest plan, developed by or under the supervision of a professional forester, to the easement holder for review prior to undertaking any timber harvest activities, with approval of such a plan based on whether the plan meets the goals and restrictions of the easement, including those required by this methodology;
    - Establishing a harvest retention level at the stand level that ensures quadratic mean diameter (QMD) increases compared to pre-harvest levels, based on trees of commercial species with a minimum diameter at breast height (DBH) as defined for each assessment area in the Assessment Area Data File;
    - Establishing any other restrictions deemed appropriate by the Eligible Land Trust to ensure an increase in timber volume across the project area while promoting mature forest conditions based on the forest type(s) comprising the property;
        - If restrictions are included that limit harvest based on timber inventory or growth, the easement must include a description of the minimum acceptable inventory confidence limits and age limits for inventory sample data.
    - Identifying conditions that would allow exceptions where harvest is required for safety and resilience to forest disturbances;
    - Identifying conditions that would allow salvage harvesting to be conducted after a natural disturbance.
- Include terms requiring reforestation of the site in the event of a loss of >50% live and dead tree canopy on >10% of the total project area as a result of harvest of any type or

[4] Land trust accredited by the Land Trust Alliance.

natural disturbance, whether through active planting, site preparation to promote natural regeneration, or passive management that otherwise allows the site to return to forest cover over time, provided passive management includes monitoring to ensure the disturbed site is recovering, with active management undertaken if monitoring indicates natural recovery is not occurring.

- Prohibit deep ripping on more than 1% of the project area in any year as determined by the area on which deep ripping is employed when using a multi-tine ripper or the area encompassed by the channels (as defined by the width of the ripper tine plus two feet on either side) produced by a single-tine ripper.
- Include as an option within the provisions for remedies in the event of violation(s) of the easement terms the restoration of the property to the condition prior to such violation(s).

2.2 Forest Owners and Project Proponents

A "forest owner" is an individual or a corporation or other legally constituted entity, or a combination thereof that has legal control of any amount of forest carbon[5] within the project area. Control of forest carbon means the forest owner has the legal authority to effect changes to forest carbon quantities, e.g., through timber rights or other forest management or land-use rights. Control of forest carbon occurs, for purposes of satisfying this methodology, through fee ownership and/or deeded encumbrances, such as conservation easements.

Multiple forest owners may exist with respect to a single MFM project, since control of forest carbon may be associated with fee ownership or through one or more deeded encumbrances that exist within a project area, any one of which may convey partial control of the project's forest carbon. Any unencumbered forest carbon is assumed to be controlled by the fee owner. Individuals or entities holding mineral, gas, oil, or similar *de minimis*[6] interests in the forest carbon without having an interest in the timber rights, are precluded from the definition of forest owner.

The "project proponent" is an entity that has an active account on the Climate Forward registry, submits a project for listing and registration with the Climate Forward, and is ultimately responsible for all project reporting and confirmation. A project proponent for an MFM project must be one of the forest owners. The term project proponent only applies to the forest owner from the project start date until completion of confirmation and FMU issuance by the Reserve, with the term not being applicable to any entity that acquires ownership of the project proponent's legal authority over the forest carbon on the project area. Nevertheless, the conservation easement placed on the project area would still restrict management of the forest under the new ownership.

In all cases, the project proponent must attest to the Reserve that they have exclusive claim to the GHG reductions resulting from the project. At the time a project is confirmed , the project proponent must attest that no other entities are reporting or claiming (e.g., for voluntary reporting or regulatory compliance purposes) the GHG reductions caused by the project.[7] The Reserve will not issue Forecasted Mitigation Units (FMUs) for GHG reductions that are reported or claimed by entities other than the project proponent.

[5] See definition of "forest carbon" in glossary.
[6] *de minimis* control includes access right of ways and residential power line right of ways.
[7] A standard form for this attestation will be posted on the Climate Forward website at https://climateforward.org/program/program-and-project-forms/.

3 Eligibility Rules

MFM projects must fully satisfy the following eligibility rules in order to be registered with Climate Forward. The criteria only apply to projects that meet the definition of an MFM project (Section 2.1).

Eligibility Rule I:	Location	→	On private lands
		→	Under forest cover for at least 20 years
		→	Not on land previously registered as a project, unless the project was closed in good standing
Eligibility Rule II:	Start Date and Crediting Period	→	Start date based on the date of recordation of conservation easement
		→	Crediting period of 100 years
Eligibility Rule III:	Additionality	→	Meets performance standard
		→	Exceeds regulatory requirements
Eligibility Rule IV:	Environmental and Social Safeguards	→	No negative environmental and social impacts
		→	Meets native species composition and diversity standards
Eligibility Rule V:	Regulatory Compliance	→	Compliance with all applicable laws
Eligibility Rule VI:	Ownership and Double Counting	→	Ownership of GHG reductions forecast for the project clearly demonstrated
		→	Compensation for conservation easement does not include foregone timber value resulting from easement restrictions
Eligibility Rule VII:	Project Resilience and Permanence Measures	→	Resilience and permanence ensured by conservation easement and required terms
Eligibility Rule VIII:	Market Expansion Objective	→	Expands opportunities for GHG mitigation to broad set of forest owners
Eligibility Rule IX:	Demonstration of *Ex Ante* Suitability	→	Conservation easement ensures forecasted carbon stock increases will occur over time

3.1 Location

MFM projects must be located on private lands under forest cover (i.e., having greater than ten percent tree[8] canopy cover) for at least 20 years. The most recent MFM Assessment Area Data File available on the Climate Forward website[9] lists eligible assessment areas (distinct forest communities within geographically defined ecoregions) as well as an indication of carbon stocking levels within each assessment area that are the result of regional harvest practices. Section 3.3.1 provides further description of the relevance of assessment areas to project eligibility.

Projects located on lands that were previously registered as a project for the financial recognition of climate benefits are not eligible unless the previous project has been closed in good standing and with the written consent of the Reserve.

3.2 Project Start Date and Crediting Period

The project start date is the date of recordation of a conservation easement that includes the language and restrictions on the project area as described in Section 2.1. The project must be submitted to Climate Forward no more than one year after the project start date, and the confirmation must be completed no later than two years after the project start date.

All projects that pass the eligibility requirements set forth in this methodology as of the project start date are eligible to register FMUs with Climate Forward for the duration of the project's crediting period. A crediting period is the length of time over which GHG emission reductions are quantified and forecast. Emission reductions for each project will be calculated as the sum of the forecasted emission reductions realized over the lifetime of the project. Crediting periods are proposed upon project submittal and established upon successful completion of project confirmation. The project proponent must also provide evidence that actions will be undertaken to maintain the project for the duration of the crediting period. Project proponents using this methodology demonstrate that the emission reductions/removals will be maintained throughout the crediting period through the recordation of a perpetual conservation easement containing the required restrictions as described in Section 2.1.

For MFM projects, the crediting period is based on the baseline established per the requirements outlined in Section 6.1, which is assumed to be valid for 100 years. Thus, a registered MFM project will be eligible to receive FMUs based on projected GHG reductions quantified using this methodology for a period of 100 years following the project's start date. The 100-year crediting period is conservative given that the project is subject to a perpetual conservation easement.

3.3 Additionality

Climate Forward registers only projects that yield surplus GHG reductions that are additional to what would have occurred in the absence of the project.

The approach to additionality for MFM projects recognizes increases in the amount of CO_2 removed from the atmosphere relative to "business as usual" management. It also considers the long-term risks to carbon sequestered in the project area presented by "business as usual"

[8] For purposes of this methodology, a tree is defined as a woody perennial plant, typically large and with a well-defined stem or stems carrying a more or less definite crown with the capacity to attain a minimum diameter at breast height of five inches and a minimum height of 15 feet with no branches within three feet from the ground at maturity.
[9] https://climateforward.org/program/methodologies/mature-forest-management/.

management and the potential emissions of such carbon into the atmosphere. Under such an approach, additionality takes into account the following:

- Onsite carbon stocks are at risk on a 100-year time scale.
- Land ownership and management direction are not permanent, except in cases where binding commitments limit management options, such as conservation easements.
- Management goals and objectives are likely to change over time, especially as ownership of a forest changes hands, as often happens between generations of family forest owners[10] or between entities owning forests as a financial investment.[11]
- Over the length of a project lifetime and in the absence of a long-term commitment to an MFM project and associated conservation easement, emissions may have resulted from the clearing of trees to convert a forest to another land cover type or from harvest activities that reduce average onsite carbon stocking.
- Committing a site to forest cover in perpetuity, as required by the conservation easement as defined in Section 2.1.

Furthermore, this methodology acknowledges that the project's baseline, as the way "business as usual" management is represented for quantification purposes, is a counterfactual scenario, i.e., a representation of what may have actually occurred if the project had never happened. Additionality is assured over the 100-year crediting period, during which the terms of the conservation easement ensure forest carbon stocks increase compared to the baseline.

MFM projects must satisfy the following tests to be considered additional:

1. The performance standard test
2. The legal requirement test

3.3.1 The Performance Standard Test

Projects pass the performance standard test by meeting a methodology-wide performance threshold – i.e., a standard of performance applicable to all prospective projects, established on an *ex ante* basis. The performance standard threshold represents "better than business as usual". If the project meets the threshold, then it exceeds what would happen under the "business as usual" scenario and generates additional GHG reductions.

The performance standard test is applied at the time of the project's start date. All projects that pass this test at the project's start date are eligible to register FMUs with Climate Forward for the duration of the project's crediting period, even if the performance standard changes after the project's start date.

MFM project activities meet the performance standard to the extent they are forecasted to produce GHG reductions in excess of those that would have occurred under the "business as usual" scenario outlined by the baseline estimation requirements in Section 6.1. The baseline for an MFM project is determined in relation to the project area's "common practice" value, which is based on the average stocks of aboveground standing live tree carbon associated with the assessment area(s) covered by the project area. Common practice statistics for each

[10] Butler, B. J., *et al*. 2016. "Family Forest Ownerships of the United States, 2013: Findings from the USDA Forest Service's National Woodland Owner Survey." *Journal of Forestry* 114 (6): 638–47. doi:10.5849/jof.15-099.
[11] Bliss, J. C., *et al*. 2010. "Disintegration of the U. S. Industrial Forest Estate: Dynamics, Trajectories, and Questions." *Small-Scale Forestry* 9 (1): 53–66. doi:10.1007/s11842-009-9101-7.

assessment area are calculated from the United States Forest Service Forest Inventory and Analysis program. These common practice statistics act as a project-specific performance standard. Common practice for an MFM project is defined in greater detail in Section 6.1.4.2 below.

3.3.2 The Legal Requirement Test

All projects are subject to a legal requirement test to ensure that the GHG reductions achieved by a project would not otherwise have occurred due to any law (including any rules, regulations, or other legally binding mandates) issued by any authority with jurisdiction over the project. The project proponent must also demonstrate that the project was not established or implemented, and was not operated at any time prior to the start date, in anticipation of, or to avoid or satisfy the anticipated requirements of any law.

The legal requirement test is applied at the time of a project's start date. To satisfy the legal requirement test, project proponents must submit a signed Attestation of Legal Additionality form prior to the commencement of confirmation activities. In addition to the attestation, the Project Implementation Report must include procedures that the project proponent will follow to ascertain and demonstrate that the project passes the legal requirement test at the time of a project's start date. All projects that pass this test at the project's start date are eligible to register reductions with Climate Forward for the duration of the crediting period, even if legal requirements change or new legal requirements are enacted during that period. The project proponent should include documentation to justify that the project passes the legal requirement test. The confirmation body must confirm the Attestation of Legal Additionality by reviewing evidence provided by the project proponent, and any other evidence they feel is necessary such as literature reviews, independent expert testimony, or letters from relevant government agency representatives, or other means. Deeded encumbrances, such as timber deeds or conservation easements, may effectively control forest carbon, such that there may be multiple forest owners within the project area. Deeded encumbrances are considered legally binding mandates for the purposes of the legal requirement test, with the exception of the conservation easement recorded as part of the project's start date.

Deeded encumbrances may contain terms that do not directly refer to forest carbon, but that nevertheless restrict the ability of any one forest owner to affect forest carbon stocks. These terms must be interpreted with respect to their effect on forest carbon for the purposes of the legal requirement test and baseline determinations. Where the terms of deeded encumbrances are not explicit with regards to forest carbon, the following assumptions shall be made:

1. Restrictions or references related to canopy cover, basal area, density, volume, carbon or biomass apply to standing live and dead trees of all species.
2. Carbon in other pools (soil, litter, duff, shrubs, etc.) is assumed to be associated with the other defined terms, such as trees.
3. Terms related to forest (tree) growth apply to growth in all tree species.

The project proponent must also identify all applicable legal requirements that cannot be modified by updating a management plan. Such legal constraints must be modelled into project's baseline so FMUs are not issued for legally required activities.

3.4 Environmental and Social Safeguards

MFM projects can create long-term climate benefits as well as provide other environmental benefits, including the sustaining of natural ecosystem processes. To be in conformance with this methodology, MFM projects, at the time of initial project confirmation, must demonstrate that the project will employ sustainable long-term harvesting practices within the project area based on required elements described in Section 2.1. The project area also must satisfy (or describe how its ongoing management will demonstrate progress toward satisfying) the following species composition requirements at the project start date:

1. Project area is composed of at least 90% native species (based on the sum of CO_2e in the standing live tree pool).
2. No single species' prevalence, measured as the percent of the basal area of all live trees in each assessment area, exceeds the percentage value shown under the heading 'Composition of Native Species' in the MFM Assessment Area Data File maintained on the Climate Forward website.[12] Where the project area naturally consists of a single species dominance, the project proponent may obtain a letter from the state forester or his/her representative stating that the project area's species diversity is reflective of background natural species diversity (despite any inconsistencies with the MFM Assessment Area Data File). If unable to obtain a letter from the state forester or his/her representative, an attestation stating the same by the professional forester with oversight of the project may be provided, subject to approval by the Reserve.

The project proponent must describe how management practices within future harvest areas, as guided by the terms of the conservation easement, will ensure the maintenance of the above species composition requirements over the course of the crediting period or, if both are not satisfied at the project start date, will result in progress toward such requirements during the crediting period.

Additionally, the project proponent must demonstrate in the Project Implementation Report how the project will not materially undermine progress on environmental and social issues such as air and water quality, endangered species and natural resource protection, and environmental justice. Any permitting requirements applicable prior to the implementation of the project activities addressed in this methodology (e.g., timber harvest plan, water quality permit) must be described in the Project Implementation Report, including a description of the status in regard to fulfilling any such requirements at the commencement of confirmation activities. The project proponent must provide existing applicable authorizations, permits, and certifications from the appropriate authorities required for project operations to the confirmation body at the commencement of confirmation activities.

Furthermore, the Reserve encourages the project proponent to include information in the Project Implementation Report regarding any non-GHG benefits of the project activities to the environment or society. This may include discussion of how the project aligns with the United Nations' Sustainable Development Goals,[13] as well as additional quantification of any non-GHG benefits (such quantification is not specified by this methodology).

[12] https://climateforward.org/program/methodologies/mature-forest-management/

[13] Additional information regarding the Sustainable Development Goals may be found online at https://sustainabledevelopment.un.org/.

3.5 Regulatory Compliance

The project proponent must sign an Attestation of Regulatory Compliance prior to the commencement of project confirmation activities, attesting that no laws have been broken in the implementation of each project, and provide an assessment of any aspects of the project which may present a risk of future regulatory violations. Where such risks are identified, the project proponent shall describe measures undertaken to reduce and/or mitigate these risks. The confirmation body shall endeavor to confirm that the project implementation did not result in any regulatory noncompliance, and also that appropriate measures have been implemented to avoid potential future noncompliance during the project crediting period, including potentially, with the terms of the conservation easement.

The conservation easement contains harvesting encumbrances that are required to be incorporated into any timber harvest plan submitted to the easement holder, as indicated in Section 2.1. The review of timber harvest plans shall occur as part of regular conservation easement monitoring activities by the holder of the conservation easement and is intended to confirm that the harvest encumbrances outlined in the conservation easement have been appropriately incorporated into any timber harvest plan. Compliance of harvest operations with all harvest encumbrances in the conservation easement, including as incorporated into the timber harvest plan, will be monitored and enforced by the easement holder.

If the project is found to be out of compliance with the conservation easement during the crediting period, remedies pertaining to non-compliance with easement terms, as specifically outlined in the easement and outlined in Section 2.1, will ensure the integrity of the project activities over time.

3.6 Ownership and Double Counting

The project proponent must attest that the project is not being submitted for emission reductions credit under any other carbon crediting program, world-wide. By signing the Attestation of Title, the project proponent attests that the FMUs have not and will not be registered with, reported in, held, transferred or retired via any emissions registry or inventory other than the Climate Forward registry, or registered with Climate Forward under a different project title or location. As described in Section 3.1, if the project area encompasses any land included as part of a prior project that was closed in good-standing with the program in which it was enrolled, the project may still be eligible, subject to approval by the Reserve. For instances in which the project area is owned by multiple forest owners, evidence of transfer of rights of all GHG emission reductions to the project proponent (based on control of carbon stocks, as described in Section 2.2) is required and must be confirmed by the confirmation body. The project proponent must provide a signed Attestation of Title document for each project, attesting to their ownership of all GHG emission reductions generated by the project. This signed attestation, and any necessary supporting evidence, must be provided to the confirmation body. In addition to the Attestation of Title, confirmation bodies may wish to review relevant contracts, agreements, and/or supporting documentation between project proponents, end users, and other parties that may have a claim to the FMUs generated by the project.

The project proponent must attest that the project is not being submitted for emission reduction credits under any other carbon crediting program. The project proponent must also attest and provide clear documentation demonstrating that the project is permanently retaining, contractually retiring, or retiring in an electronic tracking system, the environmental attributes associated with the activity for which FMUs are issued. Confirmation bodies must review contracts, purchase agreements, or tracking system reports as necessary.

Additionally, the monetary value directly realized by the Forest Owner for granting the conservation easement required under this methodology may not include the foregone timber value associated with the forest management restrictions of the easement. This will prevent Forest Owners from being compensated for both the tree-based carbon stocks (via the foregone timber value associated with the restrictions of the easement) and the carbon removals forecasted to be achieved by, and resulting FMUs issued to, the project under this methodology.

3.7 Project Resilience and Permanence Measures

As described in Section 2.1, all MFM projects are required to be secured with a perpetual conservation easement that dedicates the project area permanently to forest use. The easement acts as a legal guarantee that a project's existing and additional forest carbon stocks will remain protected in perpetuity by requiring forest management practices that increase and maintain additional carbon stocks and by ensuring that activities by a forest owner will not prevent increased carbon stocking from being achieved over time. Furthermore, the conservation easement will guarantee that forest cover will be restored on the project area following a natural disturbance.

3.8 Market Expansion Objective

Although this methodology is similar in many respects to existing offset project protocols, many forest owners may not consider undertaking an offset project under such protocols for a variety of reasons, including the long-term monitoring and reporting requirements and their associated costs. This methodology offers an opportunity for a broader contingent of forest owners to undertake meaningful and financially viable climate actions without the obligation of a long-term commitment to measuring and verifying changes to their forest carbon inventory over time. The project proponent must provide a qualitative description of why the project is not suitable under existing offset protocols. For example, the project proponent may describe the barriers to implementation under existing offset protocols and programs, such as financial infeasibility due to the project acreage and scale of anticipated carbon stock increases.

3.9 Demonstration of *Ex Ante* Suitability

By granting a conservation easement to an eligible land trust in accordance with the provisions outlined in this methodology, the project proponent provides assurances as to the administration of the easement by the eligible land trust in perpetuity, which far exceeds the project's 100-year crediting period. The project proponent must demonstrate that the eligible land trust has been granted the legal authority to monitor compliance of management activities with the terms of the conservation easement and enforce the remedies outlined in the conservation easement when violations of such terms occur. The conservation easement and related monitoring and enforcement activities ensure the continued implementation of the MFM project for the duration of the crediting period. As such, the GHG removals and/or reductions represented by the issuance of FMUs for MFM projects are secured over the long-term management of the project area. By fulfilling the requirements of this methodology, all MFM projects automatically meet the standard for demonstrating their suitability for *ex ante* crediting.

4 The Project Area

The geographic boundaries defining the project area must be described in detail at the time an MFM project is listed on the Climate Forward registry. The boundaries must be defined using a map, or maps that displays public and major private roads, major watercourses (fourth order or greater), topography, towns, and Public Land Survey Townships, Ranges, and Sections or latitude and longitude. The maps must be of adequate resolution to clearly identify the required features.

Project proponents must determine the supersection(s) within which the project area is located by consulting maps of supersections provided on the MFM Forecast Methodology page of the Climate Forward website.[14] These maps are available as both PDF files or as a geographical information system (GIS) file. Once a project's supersection(s) has been identified, the assessment area(s) must be determined. A project may do this by comparing dominant species present in the project inventory to the list of native species provided in the Assessment Area Data File. Projects may also utilize LANDFIRE Existing Vegetation Types (EVT) to determine the most appropriate assessment areas for the project. EVT descriptions must be used to identify the species descriptions that most closely match the native species provided in the Assessment Area Data File. The Reserve also reserves the right to provide a spatially explicit map of assessment areas to be used for identification purposes. The project area may also extend across multiple assessment areas within a supersection and across no more than two adjacent supersections.

A GIS file depicting the project area must be submitted to the Reserve with the project. The file must be submitted in the KML file format. Additionally, the current assessor's parcel identification numbers associated with the project area must be submitted to the Reserve.

4.1 Project Configuration and Limitations

To ensure project areas are representative of the forest owners' general forest management, MFM projects must include all forested areas owned by the Forest Owner(s) within an area no smaller than an area defined by HUC 14-digit hydrological units (HUC 14) where available (or HUC 12-digit hydrological units if HUC 14 is unavailable), or the entire area owned by the Forest Owner, whichever is smaller. HUC 14 or HUC 12 hydrological units must be identified using the USGS National Hydrography Dataset.[15] Exceptions may be provided if approved by the Reserve upon submission of the project to Climate Forward, recognizing that forest owners may have valid reasons to exclude portions of their landholdings from the project area. Such reasons may include those portions being already encumbered with legal restrictions that are incompatible with or duplicative of the requirements of this methodology, or presenting access difficulties that suggest inclusion in the project area would be impractical or result in implementation and/or administrative costs that are unreasonable. Regardless the reason, any project proponent wanting to exclude a portion of their ownership within the same watershed of the project area must conduct an analysis of the carbon stocking on such excluded lands at the project start date relative to the stocking on the project area. Such an analysis may be based on proxy measures, including timber volumes on a per acre basis or structural characteristics derived from standardized, publicly available forest cover data (e.g., LANDFIRE vegetation type, cover, and height). The results of the analysis, along with a description of why portions of the holdings of the Forest Owner(s) within the same watershed of the project area are being

[14] https://climateforward.org/program/methodologies/mature-forest-management/.
[15] The National Hydrography Dataset can be accessed via the USGS website: http://nhd.usgs.gov/.

excluded, must be included in the Project Submission form for initial consideration by the Reserve, as well as in Project Implementation Report. Exceptions to the project configuration requirement are made at the sole discretion of the Reserve.

Non-forested areas (brush, rocks, range, etc.), or areas not under forest management, may be excluded from the project area. The project area can be contiguous or separated into tracts or distinct polygons (areas).

4.2 Project Area Acreage

Project acreage shall be based on area calculations derived from GIS analysis, such as ArcGIS or Google Earth. GIS data are generally considered to be improvements over strict adherence to county parcel acreages as they are based on correcting property boundaries to geographic characteristics and/or property corners as described in property deeds or official survey notes. A KML (Google Earth) file depicting the project area shall be included with the PDD.

The project must list the county assessor's parcels (APs), the portion of each AP included in the project as a percentage (if GIS parcel data is available from the relevant state, county, or municipality), the sum of acres derived from the county tax records for all included APs, and the sum of acres derived from the GIS analysis. The sum of acres should be compared between the AP and GIS sources, with the lesser of the two used for the project area.

If there is a discrepancy between AP and GIS acres, the Project Operator has the following options:

- Resolve the acres on a per AP basis by using the lesser of the two area references.
- Work with the county assessor to resolve acreage disputes on AP acres.
- Demonstrate to confirmation body that GIS acres are based on recorded surveyed corners and correctly referenced with GPS.

5 The GHG Assessment Boundary

The GHG Assessment Boundary defines all the GHG sources, sinks, and reservoirs (SSRs) that must be assessed by project proponents in order to determine the net change in emissions caused by a project.[16] The GHG Assessment Boundary encompasses all the GHG sources, sinks, and reservoirs that may be significantly affected by MFM project activities, including forest carbon stocks, sources of biological CO_2 emissions, and mobile combustion GHG emissions.

For accounting purposes, the SSRs included in the GHG Assessment Boundary are organized according to whether they are predominantly associated with an MFM project's "primary effect" (i.e., the MFM project's intended changes in carbon stocks, GHG emissions, or GHG removals) or its "secondary effects" (i.e., unintended changes in carbon stocks, GHG emissions, or GHG removals caused by the MFM project). Secondary effects may include increases in mobile combustion CO_2 emissions associated with site preparation, as well as increased CO_2 emissions caused by the shifting of harvesting activities from the project area to other forestlands (often referred to as "leakage"). Projects are required to account for secondary effects following the methods described in Section 6.3.

Table 5.1 provides a comprehensive list of the GHG SSRs that may be affected by an MFM project and indicate which SSRs must be included in the GHG Assessment Boundary for each MFM project. If an SSR is designated as a "reservoir/pool", this means that GHG reductions and removals are accounted for by quantifying changes in carbon stock levels. For SSRs designated as sources or sinks, GHG reductions and removals are accounted for by quantifying changes in GHG emission or removal rates, as described in the tables.

Table 5.1. Description of all Sources, Sinks, and Reservoirs

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
Primary Effect Sources, Sinks, and Reservoirs					
1	Standing live carbon (carbon in all portions of living trees)	CO_2	Yes	**Baseline**: Modeled based on initial field inventory measurements, regulatory environment, and financial feasibility, with common practice as a governor **Project**: Measured initially by field inventory measurements and modeled based on silviculture restrictions, as identified in conservation easement.	Increases in standing live carbon stocks are likely to be the largest primary effect of MFM projects.

[16] The definition and assessment of SSRs is consistent with ISO 14064-2 guidance.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
2	Shrubs and herbaceous understory carbon	CO_2	No	**Baseline**: N/A **Project**: N/A	Shrubs and herbaceous understory constitute a relatively small proportion of carbon stocks in an MFM project.
3	Standing dead carbon (carbon in all portions of dead, standing trees)	CO_2	No	**Baseline**: N/A **Project**: N/A	MFM projects may significantly increase standing dead carbon stocks over time. Conservation easement restrictions under this methodology will include no harvest areas, which will recruit standing dead material.at natural rates where it will slowly decompose. There will be more standing dead carbon in project under project management than under baseline management and it is conservative not to include this pool.
4	Lying dead wood carbon	CO_2	No	**Baseline**: N/A **Project**: N/A	MFM projects may significantly increase lying dead carbon stocks over time. Conservation easement restrictions under this methodology will include no harvest areas, which will recruit lying dead material at natural rates where it will naturally decompose. There will be more standing dead carbon in project under project management than under baseline management and it is conservative not to include this pool.
5	Litter and duff carbon (carbon in dead plant material)	CO_2	No	**Baseline**: N/A **Project**: N/A	Changes in this reservoir are unlikely to have a significant effect on total quantified GHG reductions/removals. It is a conservative programmatic measure not to include it.
6	Soil carbon	CO_2	No	**Baseline**: Assumed to be static with start date inventory estimates **Project**: Changes assumed to be *de minimis*.	Soil carbon is not anticipated to change significantly as a result of MFM project activities. Furthermore, the nature of the activities that define an MFM project, including the required conservation easement provisions, prevent significant losses of soil carbon.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
7	Carbon in in-use forest products	CO_2	Yes	**Baseline**: Estimated from modeled harvesting volumes **Project**: Estimated from modeled harvesting volumes	Included because many MFM projects may significantly change carbon storage in in-use forest products relative to baseline levels. Treated as a "source/sink" because forest product carbon is quantified according to the change in harvesting volumes, relative to baseline levels. Of this change (increase or decrease), only the average amount of carbon expected to remain stored for 100 years is included in the final quantification of net GHG removals/emissions. This approach accounts for CO_2 emissions from decomposition or disposal of wood products (see SSR 17).
8	Forest product carbon in landfills	CO_2	No, when project harvesting exceeds baseline. Yes, when project harvesting is below baseline	**Baseline**: Estimated from modeled harvesting volumes **Project**: Estimated from modeled harvesting volumes	Because of significant uncertainties associated with forecasting the quantity of forest product carbon that will remain stored in landfills, landfill carbon is excluded from quantification when project harvesting volumes exceed baseline volumes. Landfill carbon is included, however, when project harvesting volumes are below baseline levels. This case-dependent exclusion or inclusion is necessary to ensure that total GHG reductions and removals caused by the MFM project are not overestimated.
Secondary Effect Sources, Sinks, and Reservoirs					
9	Biological emissions from site preparation activities	CO_2	No	**Baseline**: N/A **Project**: N/A	Biological emissions from site preparation are expected to be lower or not significantly different from baseline levels.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
10	Mobile combustion emissions from site preparation activities	CO_2	No	**Baseline**: N/A **Project**: N/A	Mobile combustion CO_2 emissions from site preparation are not expected to be significantly different from baseline levels for MFM projects. In addition, this methodology assumes that combustion emissions in the U.S. will be controlled under a regulatory cap-and-trade program in the near future, meaning that changes in activity due to the MFM project will have no effect on total net emissions.
		CH_4	No	**Baseline**: N/A **Project**: N/A	Changes in CH_4 emissions from mobile combustion associated with site preparation activities are not considered significant.
		N_2O	No	**Baseline**: N/A **Project**: N/A	Changes in N_2O emissions from mobile combustion associated with site preparation activities are not considered significant.
11	Mobile combustion emissions from ongoing project operation and maintenance	CO_2	No	**Baseline**: N/A **Project**: N/A	Mobile combustion CO_2 emissions from ongoing project operation and maintenance are unlikely to be significantly different from baseline levels and are therefore not included in the GHG Assessment Boundary. In addition, this methodology assumes that such emissions will be controlled under a regulatory cap-and-trade program in the near future, meaning that changes in activity due to the MFM project will have no effect on total net emissions.
		CH_4	No	**Baseline**: N/A **Project**: N/A	Changes in CH_4 emissions from mobile combustion associated with ongoing project operation and maintenance activities are not considered significant.
		N_2O	No	**Baseline**: N/A **Project**: N/A	Changes in N_2O emissions from mobile combustion associated with ongoing project operation and maintenance activities are not considered significant.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
12	Stationary combustion emissions from ongoing project operation and maintenance	CO_2	No	**Baseline**: N/A **Project**: N/A	Stationary combustion CO_2 emissions from ongoing project operation and maintenance could include GHG emissions associated with electricity consumption or heating/cooling at project proponent facilities, or at facilities owned or controlled by contractors. These emissions are unlikely to be significantly different from baseline levels and are therefore not included in the GHG Assessment Boundary. In addition, this methodology assumes that such emissions will be controlled under a regulatory cap-and-trade program in the near future, meaning that changes in activity due to the MFM project will have no effect on total net emissions.
		CH_4	No	**Baseline**: N/A **Project**: N/A	Changes in CH_4 emissions from stationary combustion associated with ongoing project operation and maintenance activities are not considered significant.
		N_2O	No	**Baseline**: N/A **Project**: N/A	Changes in N_2O emissions from stationary combustion associated with ongoing project operation and maintenance activities are not considered significant.
13	Biological emissions from clearing of forestland outside the project area	CO_2	No	**Baseline**: N/A **Project**: N/A	MFM projects are not expected to cause significant shifts in alternative land uses that might lead to clearing of forestland.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
14	Biological emissions/ removals from changes in harvesting on forestland outside the project area	CO_2	Yes, under certain conditions	**Baseline**: N/A **Project**: Estimated "leakage" factor applied based on the proportion of forecasted harvested carbon relative to baseline harvest amounts	MFM projects may either increase or decrease harvesting relative to baseline levels. If harvesting is reduced in the project area, harvesting on other lands may increase to compensate for the lost production. This "leakage" effect is included in the GHG Assessment Boundary. If harvesting is increased in the project area, harvesting on other lands may decrease in response to the increased production. The reduction in harvesting may lead to increased carbon stocks on other lands. Carbon stock increases on other lands are excluded from the GHG Assessment Boundary, however, because it is not possible to ensure their permanence.
15	Combustion emissions from production, transportation, and disposal of forest products	CO_2	No	**Baseline**: N/A **Project**: N/A	This methodology assumes that combustion emissions will be controlled under a regulatory cap-and-trade program in the near future. Thus, for most of an MFM project's duration, changes in activity due to the project will have no effect on total net emissions due to production, transportation, and disposal of forest products. These emissions are therefore excluded from the GHG Assessment Boundary.
		CH_4	No	**Baseline**: N/A **Project**: N/A	Combustion-related CH_4 emissions related to changes in the production, transportation, and disposal of forest products are not considered significant.
		N_2O	No	**Baseline**: N/A **Project**: N/A	Combustion-related N_2O emissions related to changes in the production, transportation, and disposal of forest products are not considered significant.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
16	Combustion emissions from production, transportation, and disposal of alternative materials to forest products	CO_2	No	**Baseline**: N/A **Project**: N/A	Changes in forest-product production may cause consumers of these products to increase or decrease their consumption of substitute materials (such as alternative building materials, including cement or steel). In many cases, alternative materials will have higher combustion GHG emissions associated with their production, transportation, and/or disposal than wood products. This methodology assumes, however, that combustion emissions will be controlled under a regulatory cap-and-trade program in the near future. Thus, for most of an MFM project's duration, changes in activity due to the project will have no effect on total net emissions due to production, transportation, and disposal of alternative materials. These emissions are therefore excluded from the GHG Assessment Boundary.
		CH_4	No	**Baseline**: N/A **Project**: N/A	Combustion-related CH_4 emissions related to changes in the production, transportation, and disposal of alternative materials are not considered significant.
		N_2O	No	**Baseline**: N/A **Project**: N/A	Combustion-related N_2O emissions related to changes in the production, transportation, and disposal of alternative materials are not considered significant.

SSR	Source Description	GHG	Included?	Baseline/ Project	Justification/Explanation
17	Biological emissions from decomposition of forest products	CO_2	Yes	**Baseline**: Quantified as a component of calculating carbon stored for 100 years in wood products (SSR 7) and landfills (SSR 8) **Project**: Quantified as a component of calculating carbon stored for 100 years in wood products (SSR 7) and landfills (SSR 8)	CO_2 emissions from the decomposition of forest products are built into calculations of how much forest product carbon will remain in in-use wood products and in landfills, averaged over 100 years (see SSR 7 and Appendix A).
		CH_4	No	**Baseline**: N/A **Project**: N/A	In-use wood products will produce little to no CH_4 emissions. CH_4 emissions can result from anaerobic decomposition of forest products in landfills. This methodology assumes that landfill CH_4 emissions will be largely controlled in the near future due to federal and/or state regulations. Thus, changes in forest-product production are assumed to have no significant effect on future CH_4 emissions from anaerobic decomposition of forest products in landfills. These emissions are therefore excluded from the GHG Assessment Boundary.
		N_2O	No	**Baseline**: N/A **Project**: N/A	Decomposition of forest is not expected to be a significant source of N_2O emissions.

6 Quantifying GHG Emission Reductions

This section provides requirements and guidance for quantifying an MFM project's net GHG reductions. The Reserve will issue FMUs to an MFM project upon confirmation by an ISO-accredited and Reserve-approved confirmation body that the MFM project's GHG reductions and removals have been quantified following the applicable requirements of this section (see Section 9 for confirmation requirements).

Quantification proceeds in seven steps:

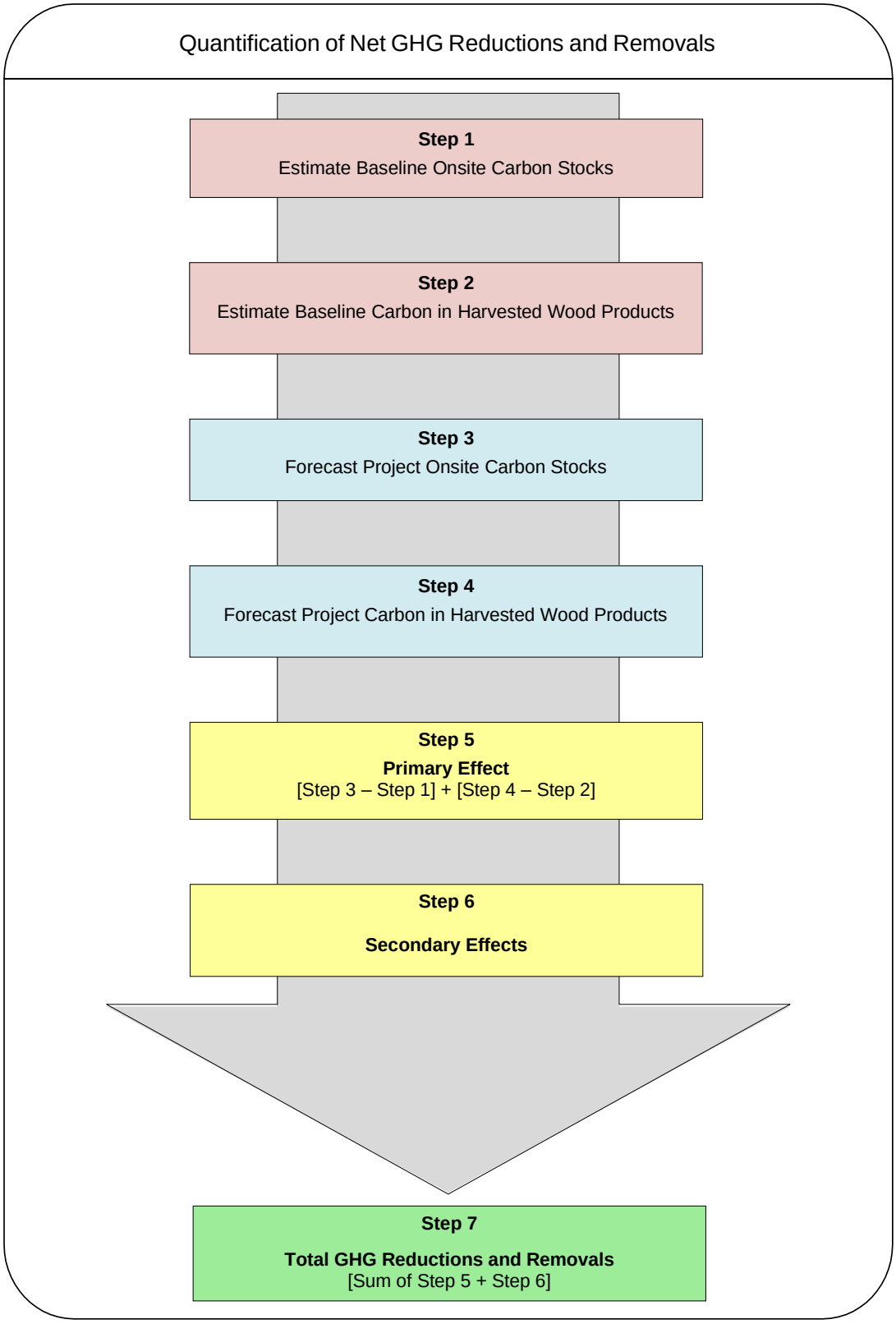
1. **Estimating baseline onsite carbon stocks.** The baseline is an estimate of what would have occurred in the absence of an MFM project. To establish baseline onsite carbon stocks, the project proponent must estimate 100 years of carbon stock changes in each of the MFM project's required onsite carbon pools (identified in Section 5). The baseline must be based on inventoried carbon stocks at the time of the MFM project's initiation, following the applicable requirements in this section for modeling. Onsite carbon stocks are inventoried following the requirements described in the Quantification Guidance in Appendix A. Modeling of onsite carbon stocks over time must be conducted following the requirements in this section and the guidance in Appendix A. Baseline onsite carbon stocks are estimated over an MFM project's entire crediting period (100 years) at the time of the project's initiation and are reported as the average onsite carbon stocking during the crediting period.
2. **Estimating baseline carbon in harvested wood products.** In conjunction with estimating baseline onsite carbon stocks, the project proponent must forecast any harvesting that would have occurred in the baseline. From this, the project proponent must determine the amount of carbon that would have been transferred to long-term storage in wood products. Baseline harvesting is estimated following the guidance in this section and carbon stored in wood products must be calculated following the requirements in the Appendix A.
3. **Forecasting onsite project carbon stocks.** The project proponent must forecast the MFM project's actual onsite carbon stocks based on anticipated management of the project area under the terms of the conservation easement. This must be done by projecting changes to the MFM project's initial forest carbon inventory forward to the end of the crediting period following the guidance in this section and in Appendix A. The estimate of forecasted onsite carbon stocks must be adjusted by an appropriate confidence deduction, as described in Appendix A.
4. **Forecasting project carbon in harvested wood products.** The project proponent must forecast harvesting in the project area based on anticipated management of the project area under the terms of the conservation easement and, from this, estimate the amount of carbon that will be transferred to long-term storage in wood products. Carbon stored in wood products must be calculated following the requirements available in Appendix A.
5. **Calculating the project's primary effect.** The project proponent must quantify the forecasted change in GHG emissions or removals associated with the Forest Project's intended ("Primary") effect, as defined in Section 5. The primary effect for the crediting period is calculated by:

   a. Taking the difference between forecasted actual onsite carbon stocks at the end of the crediting period and the average baseline onsite carbon stocks over the entire Crediting Period
   b. Adding to (a) the calculated difference between forecasted actual and baseline carbon in harvested wood products for the entire crediting period (see Equation 6.1)

6. **Quantifying the project's secondary effects.** The project proponent must quantify the forecasted change in GHG emissions or removals associated with the MFM project's secondary effects, as defined in Section 6.3. Requirements and guidance for quantifying secondary effects are provided below.
7. **Calculating total net GHG reductions and removals.** Total GHG reductions and removals are calculated by summing the project's primary and secondary effects.

Requirements and guidance for how to perform these quantification steps are presented in the remainder of this section.

The required formulae for quantifying net GHG reductions and removals is presented in Equation 6.1. Net GHG reductions and removals must be quantified and reported in units of carbon dioxide-equivalent (CO_2e) metric tons.


Quantification of Net GHG Reductions and Removals
Step 1
Estimate Baseline Onsite Carbon Stocks
Step 2
Estimate Baseline Carbon in Harvested Wood Products
Step 3
Forecast Project Onsite Carbon Stocks
Step 4
Forecast Project Carbon in Harvested Wood Products
Step 5
Primary Effect
[Step 3 – Step 1] + [Step 4 – Step 2]
Step 6
Secondary Effects
Step 7
Total GHG Reductions and Removals
[Sum of Step 5 + Step 6]

Equation 6.1. Net GHG Reductions and Removals

$$\boldsymbol{QR} = \left(\left(\left(\boldsymbol{AC_{onsite,0}}\right)(\mathbf{1}-\boldsymbol{CD}) - \boldsymbol{BC_{onsite}}\right) + \left(\boldsymbol{AC_{onsite,100}} - \boldsymbol{AC_{onsite,0}}\right)(\mathbf{1}-\boldsymbol{CD})(\mathbf{1}-\boldsymbol{RD}) + \left(\sum \boldsymbol{AC_{wp}} - \sum \boldsymbol{BC_{wp}}\right) \times \mathbf{0.80} + \boldsymbol{SE}\right)$$

Where,			Units
QR	=	Quantified GHG reductions and removals for the entire crediting period	CO_2e
$AC_{onsite,0}$	=	Actual onsite carbon at the project start date	CO_2e
CD	=	Appropriate confidence deduction for the project's inventoried carbon stocks at the start of the project, as determined following the Quantification Guidance in Appendix A	%
BC_{onsite}	=	Baseline onsite carbon as averaged across the entire crediting period	CO_2e
$AC_{onsite,100}$	=	Actual onsite carbon as forecasted for the end of the crediting period	CO_2e
RD	=	Standardized deduction of 15% to accommodate unanticipated changes in carbon stocks resulting from resilience-related management when conservation easement allows ongoing commercial harvesting of live trees and 20% to reflect the heightened risk of the loss of carbon stocks from natural disturbances when the conservation easement does not allow ongoing commercial harvesting of live trees (see Section 6.5.2)	
AC_{wp}	=	Actual carbon in wood products forecasted to be produced over the entire crediting period that is projected to remain stored for at least 100 years (i.e., derived for forecasted harvest volumes following the guidance in Appendix A)	CO_2e
BC_{wp}	=	Baseline carbon in wood products produced over the entire crediting period that would have remained stored for at least 100 years (i.e., derived for baseline harvest volumes following the guidance in Appendix A)	CO_2e
0.80	=	Net change in carbon in harvested wood products, ($AC_{wp,y}$ – $BC_{wp,y}$), is multiplied by 80 percent in Equation 6.1 to reflect market responses to changes in wood-product production. The general assumption in this protocol is that for every tonne of reduced harvesting caused by an MFM project, the market will compensate with an increase in harvesting of 0.2 tonnes on other lands (see Section 6.3). Since wood product production is directly related to harvesting levels, the net change in wood products caused by a project is subject to this same market dynamic. Thus, any one-tonne increase in wood product production by a project will result in only a 0.8 tonne increase overall, because it has been assumed other landowners will decrease production by 0.2 tonnes in response. Similarly, any one-tonne decrease in wood product production by a project will result in only a 0.8 tonne decrease overall, because it has been assumed other landowners will increase production by 0.2 tonnes in response.	
SE	=	Secondary effect GHG emissions caused by the project activity	CO_2e

Note: The term *SE* in Equation 6.1 reflects market responses to changes in wood-product production in the context of the full 100-year crediting period of an MFM project. The general assumption in this methodology is that modifying harvest in an MFM project relative to baseline harvesting levels will lead the market to compensate via modifications to harvesting levels by other landowners. The greater the change in harvest by a MFM project relative to baseline

levels, the greater the response by the market to compensate. Section 6.3 describes in detail the calculation required to account for such market responses.

6.1 Estimating Baseline Carbon Stocks

The baseline approach for MFM projects applies a standardized set of assumptions to project-specific conditions. A project must determine a start date inventory and consider how legal and financial constraints affect the baseline carbon stocks. Furthermore, performance standard criteria are applied to MFM projects based on common practice statistics, described below in this section. MFM projects must estimate baseline onsite carbon stocks following the requirements and procedures described in this section.

The approach to additionality for MFM projects relies on baseline carbon stock values averaged across 100 years. As described in Section 3.2, the crediting period for a project under this methodology is 100 years, and the baseline is a counterfactual representation of one of a multitude of potential legally compliant and financially feasible management scenarios that could play out in reality in the absence of the project. The following steps must be followed to estimate baseline carbon stocks:

1. Determine the start date inventories of aboveground standing live carbon stocks and belowground standing live carbon stocks for the project area.
2. Model a 100-year growth and harvest regime reflecting legal and financial constraints. The result is a *preliminary unadjusted baseline* for aboveground standing live carbon stocks that reasonably reflects the harvesting opportunities present within the project area.
3. Annualize the *preliminary unadjusted baseline* for aboveground standing live carbon stocks based on the periodic modeling output values. Baseline carbon stocks for other carbon pools must be similarly annualized. This results in the *unadjusted averaged baseline* for reported carbon stocks.
4. Apply performance standard criteria to adjust the aboveground standing live portion of the *unadjusted averaged baseline*. The result is an *adjusted averaged baseline* for aboveground standing live carbon stocks.
5. Proportionally adjust other reported carbon stocks to match the *adjusted averaged baseline*.
6. Combine the results to produce the *final baseline* for all onsite carbon stocks.

For all calculations in this section, all values for “carbon stocks” should be expressed in metric tons of CO_2-equivalent.

6.1.1 Inventory Carbon Stocks within the Project Area

The start date inventory of standing live carbon stocks, separated into aboveground and belowground portions must be determined following the Quantification Guidance in Appendix A. Projects may choose to use the Standardized Inventory Methodology (SIM) and/or the Climate Action Reserve Inventory Tool (CARIT),[17] but use of the SIM and CARIT is optional. Further information about the SIM and CARIT is provided in Appendix A.

[17] Both available on the Climate Forward website at https://climateforward.org/program/methodologies/mature-forest-management/.

In the formulas throughout this section, initial carbon stocks are denoted by the variable PUB_0 (i.e., the *preliminary unadjusted baseline* at time zero).

6.1.2 Model Growth and Harvesting Over 100 Years

The *preliminary unadjusted baseline* for onsite carbon stocks must be estimated through a modeling exercise that simulates the growth and harvest of forest inventories. The modeling exercise must use the inventories of the carbon from Section 6.1.1 as a starting point for modeling. The *preliminary unadjusted baseline* will consist of each of the following carbon pools that are maintained separately during this stage of baseline development:

- Aboveground and belowground standing live
- Harvested aboveground and belowground standing live
- Bole portion of harvested standing live

To determine the *preliminary unadjusted baseline,* model the initial inventory of aboveground standing live carbon stocks through a series of growth and harvesting scenarios over a 100-year timeframe, with periodic model output based on a maximum of 10 years. Modeling must be conducted using an approved growth model, as identified in Appendix A, Section A.3. Modeling of the growth and harvesting scenarios must reflect all legal requirements that constrain the ability to harvest carbon stocks in the absence of the conservation easement that serves as the basis for the MFM project. In addition, harvesting assumptions must reflect realistic financial constraints, as described in Section 6.1.2.2.

6.1.2.1 Modeling Legal Constraints

All legal constraints that affect the ability to manage carbon stocks must be included in the model design, with the exception of the conservation easement that is the basis for the MFM project. The *preliminary unadjusted baseline* must represent a growth and harvesting regime that fulfills all legal requirements. Voluntary agreements that can be rescinded, such as rental contracts and forest certifications, are not legal constraints. Habitat Conservation Plans (HCPs) and Safe Harbor Agreements (SHAs) that are in place more than one year prior to the project's start date shall be modeled as legal constraints. HCPs and SHAs that are approved after the date one year prior to the project's start date are not considered legal constraints for baseline modeling and may be disregarded.

Legal constraints include all laws, regulations, and legally-binding commitments applicable to the project area at the time of the project's initiation that could affect carbon stocks. Legal constraints include:

1. Federal, state/provincial, or local government regulations that are required and might reasonably be anticipated to influence carbon stocking over time including, but not limited to:
    a. Zones with harvest restrictions (e.g., buffers, streamside protection zones, wildlife protection zones)
    b. Harvest adjacency restrictions
    c. Minimum stocking standards
2. Forest practice rules, or applicable Best Management Practices established by federal, state, provincial or local government that relate to forest management.
3. Other legally binding requirements affecting carbon stocks including, but not limited to, covenants, conditions and restrictions, and other title restrictions in place prior to or at

the time of project initiation, including pre-existing conservation easements, HCPs, SHAs, and deed restrictions, excepting an encumbrance that was put in place and/or recorded less than one year prior to the project start date, as defined in Sections 2.1 and 3.3.1.

The *preliminary unadjusted baseline* must be modeled to reflect all silvicultural treatments associated with government-regulated timber harvest plans active within the project area at the time of the project's initiation (i.e., those harvest plans subject to oversight by a government agency and in place prior to the start of the project, as opposed to the timber harvest plan required to be submitted to the conservation easement holder under this methodology, as described in Section 2.1). All legally enforceable silvicultural and operational provisions of a government-regulated timber harvest plan (including for example, in California, those operational provisions designed to meet California Forest Practice Rules requirements for achieving Maximum Sustained Production of High Quality Wood Products [14 CCR 913.11 (933.11, 953.11)]) are considered legal constraints and must be reflected in baseline modeling if the timber harvest plan will remain active. For portions of the project area not subject to government-regulated timber harvest plans (or over time periods for which government-regulated timber harvest plans will not be active), baseline carbon stocks must be modeled by considering any applicable laws, regulations, and legally binding commitments (e.g., California Forest Practice Rules) that could affect onsite carbon stocks. On a case-by-case basis, the state agency with regulatory oversight of forest management (e.g., CAL FIRE) may assist project proponents in identifying minimum carbon stocking levels that would be effectively required under applicable forestry regulations.

6.1.2.2 Modeling Financial Constraints

Harvest assumptions included in the model must be financially viable. The project proponent must demonstrate that the growth and harvesting regime assumed for the *preliminary unadjusted baseline* is financially feasible through a financial analysis of the anticipated growth and harvesting regime that captures all relevant costs and returns, taking into consideration all legal, physical, and biological constraints. Cost and revenue variables in the financial analysis may be based on regional norms or on documented costs and returns for the project area or other properties in the project's Assessment Area.

A financially viable project is defined in this protocol as a project that has a positive net present value using a discount rate of 4% and considering long-term timber revenues and costs of production. This would indicate a management regime that does not lose money in the practice of performing long-term forest management activities, including road management, watercourse restoration, fuels management, etc. Inputs to the analysis include the volume of species harvested, logging and hauling costs, delivered log prices, and forest management costs.

6.1.3 Generate an Averaged Baseline

The periodic modeled outputs from the *preliminary unadjusted baseline* must be standardized according to the following guidance for each carbon pool. The result will be an *unadjusted averaged baseline* for each carbon pool.

Aboveground standing live carbon stocks: The periodic modeled outputs for aboveground standing live carbon stocks must be averaged using Equation 6.2. See Figure 6.1 for a simplified example of the resulting *unadjusted averaged baseline*.

Equation 6.2. Formula for Averaging *Preliminary Unadjusted Baseline* Carbon Stocks

$$UAB = \frac{\sum_{p=0}^{i} PUB_p}{i}$$

Where,			Units
UAB	=	Unadjusted averaged baseline value	tCO_2e/acre
p	=	Modeling output period	
i	=	Final modeling output period at the end of the 100-year crediting period	
PUB_p	=	Preliminary unadjusted baseline value for modeling output period p.	tCO_2e/acre

Belowground standing live carbon stocks: The belowground portion of the standing live carbon stocks must be averaged in the same way as the aboveground standing live carbon stocks.

Carbon stocks in the aboveground and belowground portions of standing live trees harvested for wood products: The carbon stocks shall be calculated as the sum of the periodic outputs for the entire 100-year modeling period.

Carbon stocks in the bole portion of trees harvested for wood products: The carbon stocks shall be calculated as the sum of the periodic outputs for the entire 100-year modeling period.

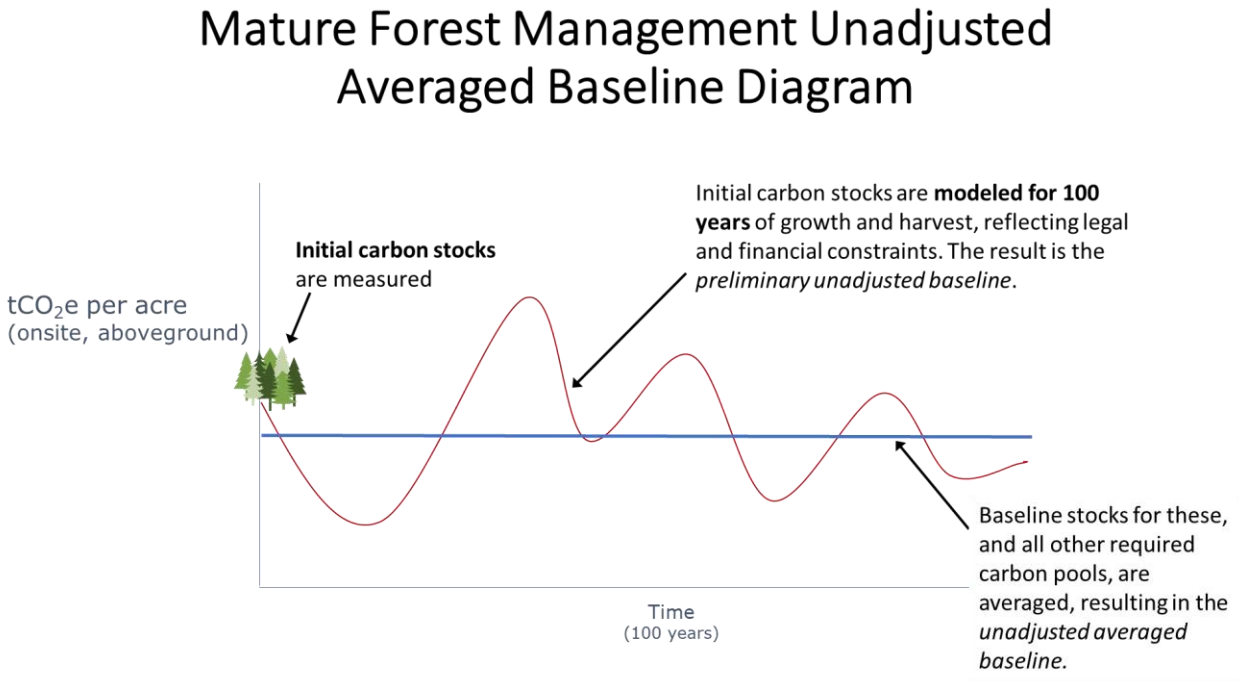


Figure 6.1. Example of an *Unadjusted Averaged Baseline* Resulting from Equation 6.2

6.1.4 Apply Performance-Standard Criteria

Once the components of the *unadjusted averaged baseline* are determined in Section 6.1.3, the aboveground standing live tree component must be adjusted to conform to a set of performance standard criteria, as described below. The result is an *adjusted averaged baseline* for

aboveground standing live tree carbon stocks. Other reported carbon pools are adjusted in Section 6.1.5.

The performance standard criteria establish minimum aboveground standing live tree carbon stock values for the baseline, regardless of what is legally and financially viable. The elements of the performance standard are:

- *The High Stocking Reference:* The High Stocking Reference is a measure of carbon stocks in aboveground standing live tree biomass over the 10 years preceding the project start date. It governs baseline carbon stocks in certain instances where aboveground standing live tree carbon stocks have declined prior to the start date. See further guidance below on how to determine the High Stocking Reference.
- *Comparison of initial carbon stocks to common practice*: The *adjusted averaged baseline* may depend on how the initial carbon stocks compare to common practice levels (see guidance in Section 6.1.4.2 for how to determine common practice). For projects whose initial aboveground standing live tree carbon stocks are above common practice, the *adjusted averaged baseline* for aboveground standing live tree carbon stocks may not be below common practice. For projects whose initial aboveground standing live tree carbon stocks are below common practice, the *adjusted averaged baseline* for aboveground standing live tree carbon stocks may not be below either (1) the initial inventory level or (2) the High Stocking Reference, whichever is greater.

The procedure for determining the *adjusted averaged baseline* is determined based on the following:

- If the project's initial aboveground standing live tree carbon stocks (PUB_0) are above common practice, use Equation 6.3
- If the project's initial aboveground standing live and standing dead carbon stocks (PUB_0) are below common practice, use Equation 6.4

Equation 6.3. Determining the *Adjusted Averaged Baseline* for Aboveground Live Tree Carbon Stocks Where Initial Stocks Are at or Above Common Practice

$$\boldsymbol{AAB = MAX(CP, MIN(PUB_0, UAB))}$$

Where,			Units
AAB	=	*Adjusted averaged baseline* for aboveground standing live tree carbon stocks value	tCO_2e/acre
CP	=	Common practice (determined according to the guidance in Section 6.1.4.2)	tCO_2e/acre
PUB_0	=	Initial aboveground standing live tree stocks per acre within the project area (as determined in Section 6.1.1)	tCO_2e /acre
UAB	=	Value of the aboveground standing live tree portion of the *unadjusted averaged baseline,* as determined in Section 6.1.3	tCO_2e/acre

Equation 6.4. Determining the *Adjusted Averaged Baseline* for Aboveground Live Tree Carbon Stocks Where Initial Stocks Are Below Common Practice

$$AAB = MAX(MAX(HSR, PUB_0), MIN(CP, UAB))$$

Where,

			Units
AAB	=	*Adjusted averaged baseline* for aboveground standing live tree carbon stocks value	tCO_2e/acre
HSR	=	"High Stocking Reference" for the project area. See guidance below for how the HSR is determined	tCO_2e/acre
CP	=	Common practice (determined according to the guidance in Section6.1.4.2)	tCO_2e/acre
PUB_0	=	Initial aboveground standing live tree carbon stocks per acre within the project area (as determined in Section 6.1.1)	tCO_2e /acre
UAB	=	Value of the aboveground standing live tree portion of the *unadjusted averaged baseline,* as determined in Section 6.1.3	tCO_2e/acre

6.1.4.1 Determining the High Stocking Reference

The High Stocking Reference is defined as 80 percent of the highest value for aboveground standing live tree carbon stocks per acre within the project area during the 10-year period preceding the project start date. To determine the High Stocking Reference, the project proponent must document changes in the project area's aboveground standing live tree carbon stocks over the 10 years prior to the initiation of the project, or for as long as the project proponent has had control of the stocks, whichever is shorter. Figure 6.2 presents a graphical portrayal of a High Stocking Reference determination.

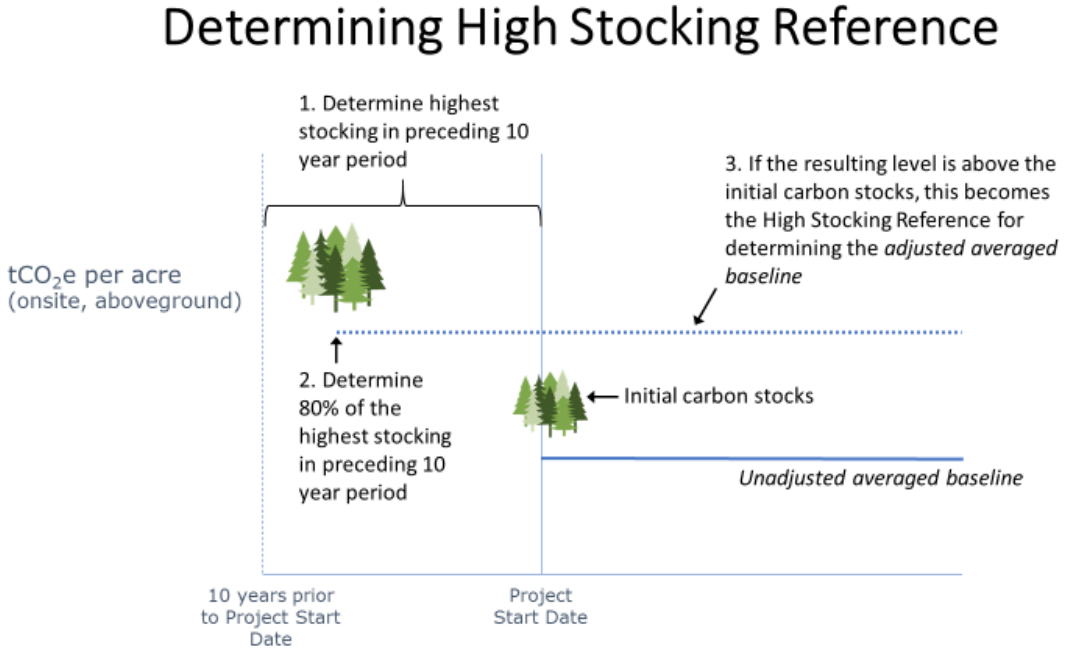


Figure 6.2. Determining a Project Area's High Stocking Reference

*It is possible for the High Stocking Reference to be higher than common practice, even where initial live tree carbon stocks for the project are below common practice.

6.1.4.2 Determining Common Practice and the Initial Baseline

Common practice refers to the average stocks of aboveground standing live tree carbon associated with the Assessment Area(s) covered by the project area. This value represents the result of the suite of management activities taking place within the Assessment Area(s) and is used to approximate a performance standard for MFM projects. The overall intent of this methodology is for projects to contribute to long-term increases in average carbon stocking in the Assessment Area(s) where they are located. Projects with initial stocking below common practice will increase their stocking over time. Projects with initial stocking above common practice will also likely increase their stocking over time, but, as or more importantly, will prevent activities that otherwise would have decreased the stocking on the project site to or below common practice stocking. In the absence of an MFM project, there is no guarantee that a site with stocking above common practice will maintain their stocking levels, especially over the 100-year crediting period committed to by projects.

The common practice statistic applicable to a project can be found by consulting the Assessment Area Data File on the Climate Forward website.[18] If the project area covers multiple Assessment Areas, common practice must be calculated as the average of the values for each Assessment Area, weighted by the percentage of the project area that falls within each Assessment Area.

Common practice statistics are calculated from United States Forest Service Forest Inventory and Analysis (USFS FIA) program. The Reserve will update the common practice statistics in the Assessment Area Data File periodically. The frequency of updating common practice statistics will be subject to the availability of new USFS FIA data but will be no more frequent than once every five years. The Reserve will announce any forthcoming updates to the common practice statistics before they are released, and any updates will not be retroactive.

6.1.5 Proportionally Adjust Other Reported Carbon Stocks

The *adjusted averaged baseline* for other reported carbon stocks must be determined by adjusting carbon stock values to reflect the *adjusted averaged baseline* for aboveground standing live tree carbon stocks. The guidance for adjusting the other reported carbon stocks is shown in Table 6.1.

[18] https://climateforward.org/program/methodologies/mature-forest-management/

Table 6.1. Guidance for Adjusting Other Carbon Pools

Carbon Pool	Relationship to Adjustments of Aboveground Live Carbon Stocks	Adjustment
Belowground Standing Live Carbon Stocks	Directly Proportional	$\boldsymbol{AAB_{bg} = \left(AAB_{ag}/UAB_{ag}\right) \times UAB_{bg}}$ *Where,* AAB_{bg} = *Adjusted averaged baseline* for belowground standing live carbon stocks AAB_{ag} = *Adjusted averaged baseline* for aboveground standing live carbon stocks UAB_{ag} = *Unadjusted averaged baseline* for aboveground standing live carbon stocks $UAB_{bg,}$ = *Unadjusted averaged baseline* for belowground standing live carbon stocks
Harvested Aboveground and Belowground Standing Live Carbon Stocks	Inversely Proportional	$\boldsymbol{TAB_{ht} = \frac{\sum_{p=0}^{i} UB_{ht,p}}{\left(AAB_{ag}/UAB_{ag}\right)}}$ *Where,* AAB_{ht} = *Totaladjusted baseline* for harvested aboveground and belowground standing live carbon stocks across the entire crediting period UB_{ht} = *Unadjusted baseline* for harvested aboveground and belowground standing live carbon stocks for the modeling period *p* UAB_{ag} = *Unadjusted averaged baseline* for aboveground standing live carbon stocks AAB_{ag} = *Adjusted averaged baseline* for aboveground standing live carbon stocks
Harvested Bole Portion of Aboveground and Belowground Standing Live Carbon Stocks	Inversely Proportional	$\boldsymbol{TAB_{htb} = \frac{\sum_{p=0}^{i} UB_{htb,p}}{\left(AAB_{ag}/UAB_{ag}\right)}}$ *Where,* TAB_{htb} = *Total adjusted averaged baseline* for the bole portion of harvested aboveground and belowground standing live carbon stocks $UB_{htb,p}$ = *Unadjusted baseline* for the bole portion of harvested aboveground and belowground standing live carbon stocks for the modeling period *p* UAB_{ag} = *Unadjusted averaged baseline* for aboveground standing live carbon stocks AAB_{ag} = *Adjusted averaged baseline* for aboveground standing live carbon stocks

6.1.6 Final Adjusted Baseline Components

The results from the *adjusted baselines* (*averaged* or *total*) for all reported *onsite* carbon stocks are applied as follows:

- *Adjusted average baseline* aboveground and belowground standing live carbon stocks are summed and are equal to the term BC_{onsite} in Equation 6.1: $\boldsymbol{AAB_{ag} + AAB_{bg} = BC_{onsite}}$
- *Total adjusted baseline* harvested standing live carbon stocks (aboveground and belowground) are equal to the summation of the term $BC_{hv,p}$ in Equation 6.5: $\boldsymbol{AB_{ht} = \sum_{p=1}^{i} BC_{hv,p}}$
- *Total adjusted baseline* harvested wood products carbon stocks are equal to the term BC_{wp} in Equation 6.1: $\boldsymbol{AB_{ag} = BC_{wp}}$

The *total adjusted baselines* for harvested standing live carbon stocks (aboveground and belowground) and the bole portion of harvested standing live carbon stocks must be maintained separately from the live tree carbon stocks *adjusted average baseline* since the reporting of harvested carbon stocks is conducted separately from other reported carbon stocks.

6.2 Estimating Project Carbon Stocks

The following steps must be followed to estimate forecasted project carbon stocks:

1. Using the start date inventory of standing live trees for the project area, as described in Section 6.1.1, model a 100-year growth and harvest regime reflecting legal constraints, including harvest constraints outlined in the Conservation Easement. The result of modeling will be periodic standing live tree inventories from which above- and belowground standing live carbon stocks are calculated for the end of the crediting period.
2. Estimate future stocks in harvested wood products based on harvest output from growth and harvest modeling.

For all calculations in this section, all values for “carbon stocks” should be expressed in metric tons of CO_2-equivalent.

6.2.1 Determining Forecasted Project Onsite Carbon Stocks

Forecasted onsite carbon stocks must be estimated through a modeling exercise. The modeling exercise must use the inventory of standing live tree carbon from Section 6.1.1 as a starting point for modeling.

Forecasted project carbon stocks will consist of each of the following carbon pools that are determined during project stock modeling:

- Aboveground and belowground standing live
- Harvested aboveground and belowground standing live
- Bole portion of harvested standing live

To determine forecasted project carbon stocks, model the initial inventory of aboveground standing live carbon stocks through a series of growth and harvesting scenarios over a 100-year timeframe. Modeling must be conducted using the same approved growth model used for

baseline modeling. Modeling of the growth and harvesting scenarios must reflect not only all legal requirements that constrain the ability to harvest carbon stocks, as required for baseline modeling as described in Section 6.1.2.1, but also the terms of the Conservation Easement that serves as the basis for the MFM project. Furthermore, modeling must be performed in a way that reflects a scenario in which harvesting occurs to the full extent allowed under the conservation easement. Project proponents must develop a modeling plan which documents how the forecasted carbon stock values were derived and describes the means by which the projections of forest carbon values adhere to the harvest constraints contained in the conservation easement.

6.2.2 Determining Forecasted Project Carbon in Harvested Wood Products

Perform the following steps to determine forecasted project carbon in harvested wood products:

1. Determine the total forecasted amount of carbon in standing live carbon stocks (prior to delivery to a mill) harvested during periodic harvest events over the entire 100-year crediting period (based on harvest volumes determined in Section 6.2.1).
2. Determine the total amount of forecasted harvested carbon that will remain stored in wood products, averaged over 100 years, following the requirements in Appendix A.

6.3 Estimating Performance Decline

The efficiency of an MFM project's mitigation performance is not expected to decline over the crediting period aside from any short-term variance that may occur in regard to annual carbon stock accrual. The conservation easement over the project area and the enforcement of terms related to forest management ensure mitigation will continue over the long-term duration of the crediting period and that any variance in annual carbon stock accruals is within any limits established by the conservation easement.

6.4 Abandonment Rates

Project abandonment is highly unlikely for any MFM project. The project proponent must grant the conservation easement to an Eligible Land Trust in accordance with the provisions outlined in this methodology. The project proponent must also demonstrate that the Eligible Land Trust has the legal authority to monitor compliance of management activities with the terms of the conservation easement and enforce such terms when violations occur. The conservation easement and related monitoring and enforcement activities ensure the continued implementation of the MFM project for the duration of the crediting period.

6.5 Ensuring Conservativeness of Quantification

6.5.1 Modeling Parameters

To help further ensure baseline and forecasted actual carbon stocks represent reasonable and conservative estimates, modeling parameters appropriate for the project area must be applied. Modeling must be performed with the oversight of a professional forester, with a description of how modeling parameters are reasonable and conservative. Parameters described should include but not be limited to:

- Site indexes, with consideration given to relevant sources of information such as inventory measurements, soil maps that indicate site productivity, and/or past harvest plans on the project area.

- Crown ratios, as reported in the project's inventory and used for modeling must be reasonably accurate, based on review by the confirmation body (see Confirmation Guidance in Section 9.4.4 for further information).
- Mortality, with the mortality function of the growth and yield model used for modeling enabled and default rates applied so that increases in live tree stocks are moderated commensurate with expected rates of natural mortality.

Additionally, modeling scenarios must be developed in a way that reflects conservative estimates of increases in forecasted actual carbon stocks. As outlined in Section 6.2.1, modeling of forecasted stocks must reflect how forest management activities are restricted by the terms of the conservation easement while also reflecting how aggressively increases in carbon stocks could be limited under allowable forest management activities. In other words, the modeling scenario must be performed as if the Forest Owner were intending to harvest as much timber as is allowed under the conservation easement. Modeling in in this way will prevent over-crediting of removals in the event the Forest Owner decides to manage the project area in a way that minimizes carbon stock increases in a manner that still complies with the conservation easement.

6.5.2 Deduction to Allow for Resilience-Related Management

Although this methodology is intended to foster increases in forest carbon stocks via management that promotes to mature forest conditions, it also recognizes that responsible long-term forest management will likely involve actions that help to ensure the resilience of the forest over time. Such actions may include operations to reduce fuel loads, remove safety hazards, and reduce snag densities after high mortality events. Rather than requiring the carbon impacts that result from such sporadic and initially unanticipated activities to be factored into the modeling of forecasted project stocks, a standard 10% deduction will be applied to the total estimated removals, as indicated in Equation 6.1.

If the conservation easement on the project area prohibits ongoing commercial harvesting of live trees, the standard deduction will be increase to 15% to accommodate the increased risk to forest carbon from catastrophic natural disturbances, such as wildfire and pest outbreaks.

6.6 Quantifying Secondary Effects

For MFM projects, significant secondary effects can occur if a project reduces harvesting in the project area, resulting in an increase in harvesting on other properties. Emission reductions due to substituting wood for materials with higher GHG footprints, such as concrete or steel, are not accounted for as an emission reduction in this methodology because the emission reductions are accounted for by the energy sector.

The risk that secondary effects may be occurring is calculated in this methodology. However, the amount of secondary effects is dependent on how much harvesting is projected to occur on the project area relative to the baseline scenario. This methodology considers the cumulative impacts of shifting harvest activities over the entire crediting period of the project. MFM projects, where harvesting is anticipated to be an ongoing activity over the project life, are expected to increase harvest levels over time compared to baseline management due to improved stocking and growth levels and harvesting closer to an optimal age for forest productivity.

Equation 6.5 must be used to estimate secondary effects for the entire crediting period for MFM projects. The evaluation in Equation 6.5 considers how forecasted harvest amounts vary from baseline harvest amounts on a cumulative basis across the entire 100-year crediting period.

Values used for onsite carbon harvested in the project and baseline scenarios ($AC_{hv,p}$ and $BC_{hv,p}$) shall represent all harvested trees, not just merchantable species.

Equation 6.5. Secondary Effects Emissions

$$SE = MIN\left(0, \left(\sum_{p=1}^{i} AC_{hv,p} - \sum_{p=1}^{i} BC_{hv,p}\right) \times 20\%\right)$$

Where,			Units
SE	=	Estimated secondary effects (used in Equation 6.1)	tCO_2e
$AC_{hv,p}$	=	Forecasted actual amount of onsite carbon harvested in model output period *p* (prior to delivery to a mill)	tCO_2e
$BC_{hv,p}$	=	Estimated baseline amount of onsite carbon harvested in model output period *p* (prior to delivery to a mill), as determined in Section 6.1.5	tCO_2e
i	=	Final model output period at the end of the 100-year crediting period	

7 Project Implementation and Monitoring

Climate Forward requires a Project Implementation Report (PIR) to be established for all implementation and reporting activities associated with the project. The PIR will serve as the basis for the confirmation body to confirm that the implementation and reporting requirements in this methodology have been met. The PIR must cover all aspects of implementation and reporting contained in this methodology and must specify how data for all relevant parameters have been collected and recorded.

At a minimum, the PIR shall include the inventory methodology, parameter values, a record keeping plan, and the role of individuals performing each implementation and reporting activities. The PIR must also include procedures that the project proponent has followed to ascertain and demonstrate that the project at all times passed the legal requirement test and will remain in regulatory compliance.

Project proponents are responsible for ensuring that all reporting requirements of this methodology have been met. Other than the initial quantification of carbon stocks and secondary effects, there are no requirements nor guidance for ongoing monitoring activities.

7.1 Quantification Parameters

Each project must include the prescribed parameters necessary to calculate emission reductions. These must be shown in a table, such as below in Table 7.1.

Table 7.1. Project Quantification Parameters

Equation	Parameter	Description	Data Unit	Calculated (c) Measured (m) Reference (r)
Equation 6.1	Onsite baseline stocks	The baseline is the "business as usual" case for MFM projects, with consideration of performance standard criteria.	CO_2e	(c) - Determined from modeling exercise as described in Section 6.1.
Equation 6.1	Onsite project stocks	Project stocks are based on projected values for the project area considering harvest activities that are allowed to occur under the conservation easement. The project stocks are discounted for conservative accounting as a measure against sampling accuracy, future management for resiliency and, in cases where ongoing commercial timber harvesting is prohibited, to address the heightened risk of catastrophic natural disturbances.	CO_2e	(c) - Determined from modeling exercise as described in Section 6.2.1.
Equation 6.1	Confidence deduction	Deduction applied to the projected inventory of onsite project stocks at the end of the crediting period based on sampling error of initial onsite carbon stock inventory.	%	(c) – Determined from sampling data for initial onsite carbon stocks.
Equation 6.1	Resiliency deduction	Standardized deduction applied to the projected inventory of onsite project stocks at the end of the crediting period.	%	(r) – Deduction applied varies as described in Equation Equation 6.1.

Equation	Parameter	Description	Data Unit	Calculated (c) Measured (m) Reference (r)
Equation 6.1	Baseline harvested wood products stocks	Baseline harvested wood products stocks are based on projected harvest volumes under the "business as usual" case for MFM projects, with consideration of performance standard criteria.	CO_2e	(c) - Determined from modeling exercise as described in Section 6.1.
Equation 6.1	Project harvested wood products stocks	Project harvested wood products stocks are based on projected harvest volumes for the project area considering harvest activities that are allowed to occur under the conservation easement.	CO_2e	(c) - Determined from modeling exercise as described in Section 6.2.2.
Equation 6.1, Equation 6.5	Secondary effects	Secondary effects emissions from the shifting of harvest activities to areas outside of the project area as a result of the project activity are based on a comparison of the cumulative harvested tree carbon stocks under the baseline and the project activity over the entire crediting period.	CO_2e	(c) – Determined from baseline and project activity modeling exercises, as described in Sections 6.1, 6.2.1, and 6.6.

7.2 Voluntary Ongoing Monitoring Incentive

Each Climate Forward methodology is designed to ensure the quantification of emission reductions over the crediting period is conservative. Under some methodologies, it may be possible to have additional FMUs issued following *ex post* verification, using data collected by the project through ongoing monitoring from the project sites. MFM projects are not eligible for further issuance of FMUs following *ex post* verification.

8 Reporting and Record Keeping

This section provides requirements and guidance on reporting rules and procedures. A priority of Climate Forward is to facilitate consistent and transparent information disclosure among project proponents.

8.1 Project Submittal and Confirmation Documentation

Project proponents must provide the following documentation for project listing with Climate Forward:

- Project Submission form, including request for exception to project configuration requirement (Section 4.1), if applicable
- Proposed conservation easement terms

After the project is listed, the project proponent must then submit the following documentation for confirmation:

- Project Implementation Report for mature forest management projects (not public)
- KML file delineating project area
- Copy of recorded conservation easement, including forest management restrictions
- Signed Attestation of Title form
- Signed Attestation of Regulatory Compliance form
- Signed Attestation of Voluntary Implementation form

As a part of the confirmation process, the confirmation body must then submit the following documentation to Climate Forward:

- Confirmation Report
- Confirmation Statement
- Confirmation List of Findings

All reports that reference carbon stocks must be submitted with the oversight of a Professional Forester so that professional standards and project quality are maintained. Any Professional Forester preparing a project in an unfamiliar jurisdiction must consult with a Professional Forester practicing forestry in that jurisdiction to understand all laws and regulations that govern forest practice within the jurisdiction. This requirement does not preclude the project's use of technicians or other unlicensed/uncertified persons working under the supervision of the Professional Forester.

All projects shall submit a KML file depicting the Project Area that matches the maps submitted to depict the project area. The project's reported acres shall be calculated in accordance with the requirements in Section 4. The Reserve will create a file of all forest carbon projects (confirmed Climate Forward projects and verified offset projects) on Google Maps for public dissemination.

The above project documentation will be available to the public via the Climate Forward online registry, unless otherwise noted. Further disclosure and other documentation may be made available on a voluntary basis through the Climate Forward registry.[19]

8.2 Record Keeping

For purposes of independent confirmation and historical documentation, project proponents are required to keep all information outlined in this methodology for a period of seven years after the information is generated. Except for those documents identified in Section 8.1, this information will not be publicly available but may be requested by the confirmation body or the Reserve. Records must be kept in hard copy and/or digital format. For documents that were originally created in hard copy form and for which the original hard copy bears original signatures or other evidence of authenticity (e.g., signed Attestation of Title), hard copies must be retained.

Examples of information the project proponent must retain includes:

- All project submittal documentation, as listed in Section 8.1.
- All data inputs for the calculation of the project GHG reductions and removals, including all required sampled data
- Copies of all permits, formal notices of regulatory violations, and any relevant administrative or legal consent orders dating back at least 3 years prior to the implementation of the project, or for as long as the project proponent has owned the project area in cases where the project proponent acquired the project area less than 3 years prior to the project start date and any such permits, notices, or consent orders are no longer applicable.
- Executed Attestation of Title, Attestation of Regulatory Compliance, and Attestation of Legal Additionality forms
- Results of emission reduction calculations
- Confirmation records and results

The Reserve also requires that the following project-related records be retained by the confirmation body for a minimum of seven years after completing confirmation activities. It must be noted that some records may be subject to fiscal or other legal requirements that are longer than the Reserve's mandated period.

Confirmation bodies shall retain electronic copies, as applicable, of:

- The Project Implementation Report
- The project proponent's SSR and/or project activity data as well as evidence cited
- The confirmation plan
- The sampling plan
- Measurement data from site visit, including sequential sampling results, as well as calculations of SSRs by confirmation body
- The Confirmation Report
- The List of Findings
- The Confirmation Statement

Each confirmation body must have an easily accessible record-keeping system, preferably electronic, that provides readily available access to project information. Copies of the original

[19] Climate Forward documents and forms are available at https://climateforward.org/program/program-and-project-forms/.

activity and source data records shall be maintained within said record-keeping system. Records must be kept in both hard copy and/or digital format, where possible. For documents that were originally created in hard copy form and for which the original hard copy bears original signatures or other evidence of authenticity (e.g., signed Confirmation Statement), hard copies must be retained. The Reserve may at any time request access to the record-keeping system or any supporting documentation for oversight or auditing purposes

8.3 Reporting and Confirmation Period

For *ex ante* GHG mitigation projects, the reporting period is equivalent to the crediting period. Project proponents must report forecasted GHG reductions from the project for the entire crediting period.

A confirmation period is the period of time over which forecasted GHG reductions are confirmed. A confirmation period begins with the project start date and ends with the submission of the final Confirmation Report to Climate Forward. The end date of any confirmation period may not extend past the project crediting end date.

Confirmation activities cannot commence until the project is submitted by the project proponent and approved by the Reserve, and at least one year following the beginning of project implementation. Under extenuating circumstances, exceptions to the requirement to wait at least one year following the project start date may be made at the sole discretion of the Reserve. In such instances, terms and conditions to be fulfilled by the project proponent are determined by the Reserve to ensure the overall integrity of the FMUs issued are maintained. See the Climate Forward Program Manual for further details.

9 Confirmation Guidance

This section provides confirmation bodies with guidance on confirming GHG emission reductions associated with the project activity. This confirmation guidance supplements the Climate Forward Confirmation Manual and describes confirmation activities specifically related to this methodology.

Confirmation bodies trained to confirm projects registering under this methodology must be familiar with the following documents:

- Climate Forward Program Manual
- Climate Forward Confirmation Manual
- Mature Forest Management Forecast Methodology (this document)

The Climate Forward Program Manual, Climate Forward Confirmation Manual, and Climate Forward methodologies are designed to be compatible with each other and are posted on the Climate Forward website at http://www.climateforeward.org.

In cases where the Climate Forward Program Manual or Climate Forward Confirmation Manual differs from the guidance in this methodology, this methodology takes precedent.

Only confirmation bodies trained and accredited by the Reserve are eligible to confirm project reports. Information about confirmation body accreditation and training can be found on the Climate Forward website at http://www.climateforward.org/program/confirmation/.

9.1 Standard of Confirmation

While there is no possibility for *ex post* verification of MFM projects under Climate Forward, there is a requirement for an accredited confirmation body to confirm each MFM project has been implemented as described in this methodology and that the estimated emission reductions or removals have been calculated accurately. The confirmation process incorporates both a desktop documentation review and a site visit assessment of the MFM project.

Beyond criteria for the confirmation of MFM project implementation, the confirmation body also confirms any provisions specified in this methodology that are to be undertaken to ensure the continued implementation of the mitigation project for the duration of its crediting period. The confirmation body assesses whether such measures have been appropriately implemented.

9.2 Confirming the Project Implementation Report

The PIR serves as the basis for confirmation bodies to confirm that the implementation and reporting requirements have been met. Confirmation bodies shall confirm that the PIR covers all aspects of implementation and reporting contained in this methodology and specifies how data for all relevant parameters were collected and recorded.

When assessing the PIR, the confirmation body shall:

a) Assess the compliance of the PIR with the requirements of this methodology Climate Forward Program Manual, and Climate Forward Confirmation Manual;

b) Identify the list of parameters required by this methodology and confirm that the PIR accounted for all necessary parameters;

c) Assess the means of implementation of the project data capture, including data management and quality assurance and quality control procedures, and determine whether these are sufficient to ensure the accuracy of forecasted GHG reductions to be achieved by the project;

Where the project proponent has applied a sampling approach to determine data and parameters, the confirmation body shall assess the proposed sampling plan in accordance with sampling requirements in section 6.1.3.6.3 of ISO 14064-3: 2019.

9.3 Core Confirmation Activities

Confirmation is a risk assessment and data sampling effort designed to ensure that the risk of reporting error is assessed and addressed through appropriate sampling, testing, and review. The core confirmation activities are:

1. Reviewing project documentation for project compliance with eligibility requirements, conformance of the conservation easement terms, estimates of the carbon stock inventory, and modeling of future stocks under the baseline and project scenarios
2. Confirming emission reduction estimates
3. Undertaking site visits to evaluate the project's inventory estimates

9.4 Confirmation Items

Confirmation bodies are expected to use their professional judgment to confirm that methodology requirements have been met in instances where the methodology does not provide sufficiently prescriptive guidance. For more information on the confirmation process and professional judgment, please see the Climate Forward Confirmation Manual.

Note: These tables shall not be viewed as a comprehensive list or plan for confirmation activities, but rather guidance on areas specific to mitigation projects that must be addressed during confirmation.

9.4.1 Project Eligibility

To determine that a project is eligible under this methodology, it must meet a set of criteria that a confirmation body shall confirm during the confirmation process. These requirements determine if an MFM project is eligible to register with Climate Forward and/or have credits issued. If any requirement is not met, the project may be determined ineligible. Table 9.1 outlines the eligibility criteria for MFM Projects.

Table 9.1.Eligibility Confirmation Items

Confirmation Items		Section of Methodology	Apply Professional Judgment?
1. **Project Definition**	a. Conservation easement that serves as the basis for the MFM project has been granted to an eligible land trust that has the legal authority to enforce the terms of the easement against others, including the landowner. b. Conservation easement has been recorded with the county or counties in which the project is located. c. Conservation easement contains the required terms that restrict timber harvesting during the crediting period in accordance with the requirements described in this methodology. d. Conservation easement properly references the state enabling statute for conservation easements in the state in which the project is located.	2.1	No
2. **Project Ownership**	Forest Owners are identified, including documentation of control of carbon within the project area.	2.2, 3.6	No
3. **Project Location**	a. Project is on private land. b. Assessment Area(s) containing the project area are identified. c. Evidence is provided indicating the canopy cover exceeds 10% and has existed on the project area for at least 20 years. d. Project is not on lands under a prior carbon project, unless the prior project was	3.1	No
4. **Start Date**	Evidence of date of recordation of Conservation Easement	3.2	No
5. **Legal Requirement Test**	Proof that a signed Attestation of Voluntary Implementation form is on file with the Reserve	3.3.1	No
6. **Native Species**	Evidence that the project area comprises at least 90% Native Species (based on the sum of carbon in the standing live tree pool) at the project start date, or that the conservation easement will guide management practices in future harvest areas to ensure progress toward satisfying the requirement over the course of the crediting period.	3.4	No
7. **Composition of Native Species**	Completed inventory demonstrates distribution of average basal area of standing live tree species meets composition of native species goal or an exception has been made through a letter from the State Forester or by a Professional Forester, as described in Section 3.4. If composition goal is not achieved at the	3.4	No

	project start date, evidence has been provided that the conservation easement will guide management practices in future harvest areas to ensure progress toward satisfying the requirement over the course of the crediting period.		
8. **Attestation of Regulatory Compliance**	Proof that a signed Attestation of Regulatory Compliance form is on file with the Reserve. In addition to reviewing this form, the confirmation body must perform a risk-based assessment to confirm the statements made by the project proponent in the Attestation of Regulatory Compliance form.	3.5	Yes
9. **Ex Ante Suitability**	Proof that the conservation easement, containing the terms as specified in Section 2.1, has been granted to an Eligible Land Trust	2.1 ,3.5	No
10. **Attestation of Title**	Proof that a signed Attestation of Title is on file at the Reserve for the initial confirmation. In addition to reviewing this form, the confirmation body must conduct a review to confirm ownership and claims to GHG reductions/removals that are anticipated as part of the project activity.	3.6	Yes
11. **Compensation for Conservation Easement**	Evidence that the Forest Owner has not been compensated (via cash value or tax deductions owing to the conservation easement) for the foregone timber value associated with the forest management restrictions contained within the conservation easement.	3.6	No
12. **Project Resilience and Permanence Measures**	Conservation easement contains terms that ensure the resilience of GHG reductions/removals associated with the project.	3.7	No

9.4.2 Quantification

Confirmation bodies shall include quantifications within the confirmation process such as recalculations and risk assessment. These quantification items inform any determination as to whether there are material and/or immaterial misstatements in the project's GHG emission reduction calculations. If there are material misstatements, the calculations must be revised before FMUs are issued.

Use the following table to list the items that confirmation bodies shall include in their risk assessment and recalculation of the project's GHG emission reductions.

Table 9.2. Quantification Confirmation Items

Confirmation Items		Section of Methodology	Apply Professional Judgment?
1. **Project Area Delineation**	Proof that a description, KML layer, and maps of the geographic boundaries defining the project area are on file at the Reserve.	4, 7.1	No
2. **Inventory of Onsite Carbon Stocks**	An inventory of the project area's carbon stocks in required pools has been conducted in accordance with the requirements of this methodology (see Section 9.4.3 for further confirmation guidance).	6.1	Yes
3. **Description of Project Activities**	A description has been provided of the management activities that will lead to increased carbon stocks in the project area compared to the baseline, as supported by the conservation easement.	2.1, 6.2	Yes
4. **Compare Initial Aboveground Standing Live Carbon Stocks with the Minimum Baseline Level**	a. Initial aboveground standing live carbon stocks have been estimated correctly following the requirements of this methodology. b. The baseline analysis utilizes the correct value for common practice c. The project has undertaken the correct baseline analysis, according to whether initial carbon stocks are above or below common practice.	6.1, Assessment Area Data File, Appendix A	No
5. **Carbon Stock Modeling**	a. A 100-year forest management simulation of baseline standing live carbon stocks has been conducted in accordance with the requirements and guidance in Section 6.1.2 (see Section 9.4.4 for further confirmation guidance). b. Project scenario stocks have been projected using a 100-year forest management simulation of standing live carbon stocks in accordance with the requirements and guidance in Sections 6.2.1 and 6.5, including the restrictions on forest management described in the Conservation Easement.	6.1.2, 6.2.1, Appendix A	Yes. Professional judgement shall be based on review of growth model used and parameters (site class, mortality, regeneration, etc.) included.
6. **Harvest Volume**	a. The total volume of harvesting in the baseline has been derived from the growth and harvesting regime used to develop the baseline for onsite carbon stocks, following the requirements and guidance in Section 6.1 (see Section 9.4.5 for further confirmation guidance). b. The total volume of harvesting forecasted for the project has been derived from the growth and harvesting regime used to develop the forecasted project scenario simulation for onsite carbon stocks, following the requirements and guidance in	6.1, 6.2, Appendix A	No

	Section 6.2 (see Section 9.4.5 for further confirmation guidance).		
7. **Long-Term Storage in Wood Products**	a. The total amount of carbon expected to be transferred to wood products under the baseline and stored over the long-term (100 years) has been calculated following the requirements of Section 6.1 and guidance of Appendix A (see Section 9.4.5 for further confirmation guidance). b. The total amount of carbon expected to be transferred to wood products under the forecasted project scenario and stored over the long-term (100 years) has been calculated following the requirements of Section 6.2 and guidance of Appendix A (see Section 9.4.5 for further confirmation guidance).	6.1, 6.2, Appendix A	No
8. **Quantification of Primary Effect**	Calculations for the primary effect are complete and accurate for both onsite carbon stocks and harvested wood products.	6	No
9. **Quantification of Secondary Effects**	Calculations for quantifying secondary effects are complete and accurate.	6.3	No
10. **Approach to Quantification Conservative-ness**	Parameters used to model the forecasted project scenario reflect appropriately conservative values as outlined in Section 6.5, with oversight by a professional forester and a description of how parameters were determined included in the PIR. Standard deduction to accommodate for future resilience-related management activities has been applied properly. For projects involving a conservation easement that prohibits commercial harvesting of live trees, the increased standard deduction has been applied to reflect the elevated risk of natural disturbances,	6.5, 6.5.2	Yes, to review whether modeling parameters are reasonable

9.4.3 Confirming Carbon Inventories

Confirmation bodies are required to confirm carbon stock inventory estimates of all sampled carbon pools within the project area. Inventories of carbon stocks are used to determine the project baseline and to forecast GHG reductions and removals against the project baseline over time. Confirmation of carbon inventories consists of ensuring the project proponent's sampling implementation conforms to requirements listed in the methodology and that the Project's inventory sample plots are within specified tolerances when compared to the confirmation body's sample plots. Confirmation is effectively an audit to infer that the inventory estimate is sound. Confirmation of the project's initial onsite stocks must occur during the confirmation site visit and focus on ensuring that the project's inventory methodology is technically sound and has been correctly implemented.

The project must meet the inventory standards in Table 9.3 prior to the confirmation body initiating field sampling activities. The confirmation body will install sample plots or re-measure existing monumented sample plots consistent with the objectives of a random, risk-based, and efficient approach. In doing so, the confirmation body may weigh the probability of selecting strata and plots based on various criteria – including carbon stocking, access difficulty, and vegetation heterogeneity. Confirmation bodies may choose to sample project plots within a given stratum with a cluster design. The selection of a stratum may use probability proportional to carbon stocks or probability proportional to the risk of errors (as hypothesized by the confirmation body).

9.4.3.1 Sequential Sampling for Confirmation

As a policy to ensure a trend of agreement with sampled data is sustained between the confirmation body and project proponent, this methodology requires a sequential sampling method for confirmation of project estimates. Sequential sampling is intended to provide an efficient sampling method for the confirmation body to determine if randomly selected project measurements are within specified tolerance bounds established by the methodology.

Confirmation using the sequential sampling methodology requires the confirmation body to sequentially sample successive plots. Sequential approaches have stopping rules rather than fixed sample sizes. Confirmation is successful after a minimum number of successive plots in a sequence indicate agreement. Where the stopping rules indicate the potential presence of a bias, additional confirmation plots may be collected after that time if it is felt that random chance may have caused the test to fail and a convergence towards agreement is expected with additional confirmation samples. The results of any additional confirmation plot may also be inconclusive and require additional confirmation plots for a determination to be made. For effective application of the sequential statistics in the field, the determination of when the stopping rule is met is done when convenient for the confirmation team, which will include the full set of plots measured in that timeframe.

Worksheets are provided for use by confirmation bodies to assist in confirmation sampled data. Confirmation bodies will review the descriptive statistics of the carbon stocks for the standing live tree pool.

To increase efficiency in the confirmation process, three nested levels of sequential sampling are processed in the sequential sampling worksheets, based on a single sampling exercise performed by the confirmation body. All tests are performed with the same randomly selected plots and can only be completed by analysis of the plots in the sequential order they were randomly selected. However, inventory data is only considered successfully confirmed when the stopping rules for the CO_2e/acre test have been met. Passing the diameter and height tests (only applicable to paired sequential sampling) only improves the overall efficiency of the confirmation effort. The data identified below used for each test are input into the appropriate sequential sampling tool.

- CO_2e/acre: The testing of inventory data can only be satisfied when the CO_2e/acre comparison between the confirmation body and project proponent is completed. This test is conducted on a plot by plot basis using estimates of CO_2e/acre. The confirmation body's estimates of CO_2e/acre are derived by measurements of diameter and height (measured by confirmation body or using project proponent's data, as described below), species determinations, defect and decay determinations, and a determination of the appropriate trees to be included in the sample ("in" or "out" trees).

- Diameter Test (paired sequential sampling only): A comparison of diameter data between the confirmation body and the project proponent is conducted on a tree by tree basis until sequential sampling stopping rules have been achieved, indicating that the confirmation body and project proponent measurements of diameter are aligned within acceptable tolerance levels. If the stopping rule for diameter is met before the sequential sampling exercise has ended for CO_2e/acre, confirmation bodies may stop taking their own diameter measurements and may instead use the diameter data provided for each tree from the project proponent's database for any additional data inputs needed for the CO_2e/acre comparison. If this happens, the focus of the sampling exercise from that point on will be measuring height (if applicable, see below), making species determinations, defect and decay determinations, and "in" or "out" tree assessments.
- Height Test (paired sequential sampling only): Like the diameter test, a comparison of height data is performed between the confirmation body and the project proponent until sequential sampling stopping rules have been achieved, indicating that the confirmation body and project proponent measurements of height are aligned within acceptable tolerance levels. If the stopping rule for height is met before the sequential sampling exercise has ended for CO_2e/acre, confirmation bodies may stop taking their own height measurements and may instead use the height data provided for each tree from the project proponent's database for any additional data inputs needed for the CO_2e/acre comparison. If this happens, the focus of the sampling exercise from that point on will be measuring diameter (if applicable, see above), making species determinations, defect and decay determinations, and "in" or "out" tree assessments.

Separate worksheets have been developed to assess both monumented (paired) and non-monumented (unpaired) plots as well as for DBH, height, and CO_2e/acre. Worksheets are found on the Climate Forward website.[20]

The Reserve has established a ten percent allowance as an acceptable level of agreement between CO_2e/acre estimates of the confirmation body and the project proponent, without adjusting the project estimates for uncertainty.

9.4.3.2 Inventory Estimates

The items in Table 9.3 are evaluations that should be made before the confirmation body goes to the field and analyzes the plots. If a project opts to utilize the SIM, the methodology need not be assessed beyond correct implementation.

[20] https://climateforward.org/program/methodologies/mature-forest-management/

Table 9.3. Inventory Methodology Confirmation Items

Confirmation/Evaluation Standards	
1.a	Inventory methodology describes the methodology for plot location in the field. The plot locations are either random or systematic with a random initial point.
1.b	If inventory methodology describes a stratification design: The stratification methodology, including rules for stratification, is clearly defined. The stratification design is relevant for the sampling of biomass. In particular, the stratification design applies to all tree species without a bias for commercial tree species. Confirmation Body shall randomly select 10% of the vegetation units, or strata polygons, by area, or 500 acres (whichever is least) to evaluate that the vegetation (or stratum) label assigned to the polygon is consistent with the stratification rules documented in the inventory methodology. The selection shall be made from a database or spreadsheet list of all vegetation (stratum) polygons within the project area that have not experienced a harvest or disturbance that affects carbon stocks by more than 10%, using confirmation body judgment, within the past 10 years. Evaluation for consistency shall be conducted through comparison with aerial photos or other remotely sensed data, and/or field observation. During evaluation, a confirmation body must use professional judgment to determine if a polygon is consistent or inconsistent with the stratification rules. Inconsistent means the existing vegetation (stratum) label is grossly incorrect to an extent that would substantially alter the associated carbon stocks. If more than 10% of the polygons evaluated are determined to be inconsistent with the stratification rules documented in the inventory methodology, the confirmation shall expand the assessment to an additional 10% of the vegetation units (stratum polygons), or an additional 500 acres (whichever is least) and expand the analysis or determine that the project has failed to meet the standard.
1.e	The inventory methodology describes the volume and biomass equations used to compute the project's carbon stocks and these equations are consistent with those required by this methodology. Appropriate use of biomass equations is demonstrated. The carbon tonnes per acre, computed using the project proponent's calculation tools, replicate output computed by the confirmation body. All conversions and expansions are accurate.

Each applicable pool/combination of pools must meet the minimum precision threshold of +/- 20 percent at the 90 percent confidence interval.

Use of the SIM (available on the Climate Forward website[21]) will be considered to automatically meet the evaluation standards in Table 9.3 and does not need to be confirmed beyond ensuring proper implementation. The Reserve has also developed CARIT, an inventory management computer application that project proponents may also optionally use to manage their forest inventories. The use of the SIM does not obligate a project proponent to use CARIT, nor does the use of CARIT obligate a project proponent to use the SIM. However, CARIT will only

[21] https://climateforward.org/program/methodologies/mature-forest-management/

function properly if certain inventory standards are followed. Refer to Appendix A for more information.

9.4.3.3 Measurement Specifics for Confirmation Body

Confirmation bodies must use the highest standard to conduct measurements during field measurements because the confirmation bodies' measurements have precedence. Measurements utilized by confirmation bodies during field inspections shall be consistent with the tolerance standards for measurements identified in Appendix A, with the following exceptions:

1. Confirmation bodies shall measure the heights of all trees, unless stopping rules are achieved as described above, according to the height measurement used for the species-specific biomass equation on the Climate Forward website for comparison with project proponent's values. Confirmation bodies shall not use regression equations to generate height measurements.
2. Tools and methods used for distance measurements for plot boundaries should be accurate within 1"/30'.
3. Tools and methods used for distance measurements for height measurements must be able to obtain an accuracy of 6"/100'.
4. All borderline trees should be measured to determine status as an 'in' or 'out' tree.
5. Confirmation bodies shall insert their own determination of species for each tree included in the confirmation body's inventory.
6. For defect and decay, confirmation bodies may first consider the inputs of the Forest Owner and determine whether they were reasonable. If considered reasonable, the confirmation body may insert the same classification as the Forest Owner for each tree included in the confirmation body's inventory. If, however, not considered reasonable, or not recorded by the Forest Owner, the confirmation body shall insert its own determination.

9.4.3.4 Confirming a Stratified Inventory

If the project proponent's inventory is based on a stratified design, confirmation shall be based on the measurement error that can be assessed at the stratum level, using the sequential sampling tools developed by the Reserve. Individual plots within the strata selected for assessment shall be selected randomly. The confirmation body shall perform independent assessments on a minimum of three strata, unless the stratification design has less than three strata, in which case the assessment is conducted on two strata. Confirmation bodies shall select the strata used to perform the assessment based on their own professional judgement of where the risks of measurement error are likely to have the biggest effect on the overall inventory estimate. This may be based on criteria related to:

- Carbon stocking levels
- Area of a particular stratum relative to other strata
- Strata that may be found in difficult to access areas due to remoteness or terrain which could lead to a reduced effort by forest inventory personnel

9.4.3.5 Confirming a Non-Stratified Inventory

If the project is not stratified for each applicable pool, the confirmation body shall select the plots randomly (if plot center can be located) or allocate the plots systematically or in clusters for

efficiency. Plots may be measured and assessed one at a time or in reasonable batches that correspond to logistical realities of fieldwork.

9.4.3.6 Confirmation Within Strata

Plots must also be independently selected using a random or systematic design. The project passes sequential sampling when the minimum number of passing plots in sequence is achieved (as identified in Table 9.4), or the first passing plot after a minimum of 12 plots (paired) or 30 plots (unpaired) have been measured – whichever is achieved first.

Table 9.4. Number of Passing Plots in Sequence, as a Function of Project Size

Test	Number of Strata Confirmed	Project Acres				
			<100 – 500	501 - 5,000	5,001 – 10,000	>10,000
Paired/Unpaired	3		3	4	5	6
	2		4	6	8	10
	1		8	10	12	12

There are two possible statistical procedures that can be applied to the stratum-level confirmations. A paired test can be applied when plot locations can be found and it is statistically appropriate to use a paired test (i.e., plot measurements can be replicated). An unpaired test can be applied when plots cannot be relocated. The range of acceptable error (***δ*, delta**) is fixed at ten percent for both tests.

Paired Plots

The statistical test is based on a comparison of the confirmation body's measurements of plots within a selected stratum, calculated as CO_2e compared to the project proponent's measurements of plots, which may include any adjustments for growth.

Use α**=0.05** and β**=0.20** to control for error.

The null hypothesis (H_0) is that the confirmation and project plots are equal.

1. Perform confirmation sampling on at least the minimum number of passing plots required in a sequence from Section 9.4.3.4.

2. If $n \geq ((Z_\alpha + Z_\beta)^2 \times S_n^2) / D^2$ then stop and evaluate. Otherwise take another sample.

   Where,
   n = Number of confirmation plots measured
   $Z_\alpha = \alpha\%\ N(0,1) = 1.645$
   $Z_\beta = \beta\%\ N(0,1) = 0.8416$
   S_n^2 = sample variance of the differences
   $D = \delta \times$ project average estimate

3. If stopped, then evaluate.

   If $\bar{X}_N \leq K$ then accept H_0,
   If $\bar{X}_N > K$ then reject H_0.

Where,
$\bar{X}_N$ = sample mean of the differences
N = total number of plots measured
$K = (Z_\alpha \times D) / (Z_\alpha + Z_\beta)$.

4. If H_0 was rejected, then additional samples may be taken as long as the confirmation body is of the opinion that there is a chance that H_0 may be accepted based on the variability and trend observed.

Unpaired Plots

The statistical test is based on comparing the average CO_2e estimates for each stratum from the confirmation body's plots to the project proponent's plots.

Use $\boldsymbol{\alpha}$**=0.05** to control for error; the β is not specified because we are constructing a confidence interval not a test. The null hypothesis (H_0) is that the confirmation and stratum averages are equal. The following procedure is appropriate for the unpaired test.

1. Perform confirmation sampling on at least the minimum number of plots required in a sequence from Section 9.4.3.5. Calculate *n* as the sum of the number of plots from both the stratum and the confirmation.

2. Calculate the following:

$$T_n = \bar{X}_P - \bar{X}_n$$

Where,
T_n = the difference between the means
$\bar{X}_P$ = stratum mean,
$\bar{X}_n$ = confirmation mean after sample n.

3. If $\boldsymbol{n \geq (a^2/D^2) \times (S_n^2 + S_P^2)}$ then stop and evaluate. Otherwise take another sample.

Where,
$n = n_p + n_v$
a = the percentile from a standard normal distribution for one half of alpha; 1.96 for α=0.05
S_n^2 = sample variance of the confirmation plots
S_P^2 = sample variance of the stratum plots
$D = \delta \times$ stratum average estimate

4. If stopped, then evaluate. Construct a confidence interval $T_n \pm D$.
If the confidence interval includes zero then accept H_0,
Otherwise reject H_0.

5. If H_0 was rejected, then additional samples may be taken until as long as the confirmation body is of the opinion that there is a chance that H_0 may be accepted based on the variability and trend observed.

If the stopping rule in step (3) above cannot be attained within 100 plots then apply a standard unpaired t-test comparison using α**=0.05** and β**=0.80**.

9.4.3.7 Determining if the Stopping Rules Have Been Met

The confirmation body must determine if the stopping rules have been met for each stratum as soon as is convenient for the confirmation body. The Reserve provides tools to assist confirmation bodies with determining if the stopping rules have been met or not. The tools are Microsoft Excel based and are distinct for paired designs and for unpaired designs.

The confirmation body must enter their data into the appropriate spreadsheet based upon use of a paired or unpaired test. It is required that the confirmation body apply the random order selection in the sampling process. The confirmation body is free to measure the set of plots that were randomly selected in any order that provides the greatest efficiency while sampling in the field, but when the confirmation body inputs data into the spreadsheet, the confirmation body must follow the random selection order in order to properly conduct the analysis and maintain the integrity of sequential analysis. This may provide significant efficiencies when selected stands and/or plots are in close geographic proximity and it is hypothesized that the stopping rules will require the full number of plots.

The statistical test is based on a comparison of the confirmation body's measurements of plots, calculated as CO_2e per acre compared to the Forest Owner's measurements of plots, which may include any adjustments for growth. The inventory confirmation is complete based on the stopping rules detailed in Section 9.4.3.1. Passing of the plot height and/or diameters (DBH) is not required to pass the inventory confirmation; however, as discussed above, confirmation bodies may separately compare their measurements for height and diameter with the Forest Owner's measurements in the sequential sampling tool. When those inputs have met the sequential sampling requirements, confirmation bodies shall use the height and diameter data provided for each tree from the Forest Owner's database for any additional data inputs needed for the CO_2e/acre comparison.

9.4.4 Baseline and Forecasted Project Stock Estimation

Confirmation bodies are required to confirm the baseline and forecasted project stock estimates for MFM projects. Baselines and forecasts of project stocks include assumptions about forest growth and harvest, as influenced by legal and financial constraints, as well as assumptions regarding the extent of harvest operations under "business as usual" conditions (for the baseline) or regarding how harvests are constrained by the terms of the conservation easement (for project stock forecasts), as described in Section 6.

All reports that reference carbon stocks must be submitted by the project proponent with the oversight of a Professional Forester, as described in Section 8.1.

Table 9.5 shows specific items that must be confirmed. A summary of these items must be included in the PIR.

Table 9.5. Modeled Baseline and Forecasted Project Stocks Confirmation Items

Confirmation Items		Section of Methodology	Apply Professional Judgment?
1. **Document**	A modeling document exists that contains all the confirmation items in this table.	8	No
2. **Qualitative Characterization**	A sufficiently detailed qualitative characterization has been included in the modeling document that documents the general assumptions of the project's baseline and forecasted project projection. The qualitative assessment addresses the vegetative conditions and activities that would have occurred.	6.2	Yes
3. **Model Choice and Calibration**	a. The model used is an approved model. b. The project proponent has provided a rationale for any model calibrations or a sufficient explanation of why calibrations were not incorporated. c. The project proponent has provided, with the oversight of a professional forester, a description of the site indexes used for each species and the basis for each value, citing relevant supporting information, such as inventory measurements, soil maps covering the project area, and/or the site classes indicated in past harvest plans on the project area,. d. Reported crown ratios are reasonably accurate, based on the weighted average of the crown ratios reported for sequential sampling plots being no more than 10% greater than the confirmation body's estimate. e. Mortality function of the model used is demonstrated as being used, with default rates applied.	6.5, Appendix A	Yes
4. **Legal Constraints**	A list of legal constraints is provided that includes an accurate description of the type and effect of each constraint on the ability to harvest trees and the area constrained.	3.3.1, 6.1.2, 6.2.1	Yes
5. **Financial Constraints**	a. A sufficient qualitative description is provided indicating that the harvesting activity modeled in the baseline is a financially viable activity. b. The project proponent has provided a financial analysis of the anticipated growth and harvesting regime for the baseline that captures all relevant costs and returns, taking into	3.3.2, 6.1.2, 6.2.1	Yes

Confirmation Items		Section of Methodology	Apply Professional Judgment?
	consideration all legal, physical, and biological constraints.		
6. **Silviculture Guidelines**	The silviculture guidelines incorporated in the model demonstrate all legal constraints and Conservation Easement terms (for forecasted project stock modeling) are applied appropriately. The silviculture guidelines must include: i. A description of the trees retained by species group (commercial vs. non-commercial) ii. The level of retention iii. Harvest frequency iv. Regeneration assumptions v. Any other variables included in the conservation easement for forecasted project stock modeling.	Appendix A	No
7. **Modeling Guidelines**	Modeling is conducted per Section 6.1 (for baseline) and Section 6.2 (for forecasted project scenario).	6.1, 6.2	No
8. **Modeling Outputs**	a. The project proponent has provided reports that display periodic harvest, inventory, and growth estimates for the entire project area for both baseline and forecasted project stocks, presented as total carbon tonnes and carbon tonnes per acre. b. Estimates are within the range of expected growth patterns for the project area.	8, Appendix A	Yes

9.4.5 Confirming Estimates of Carbon in Harvested Wood Products

Confirmation bodies are required to confirm the estimates of carbon that are likely to remain stored in wood products over a 100-year period, as submitted in the PIR for both baseline estimates and for project stock forecasts under terms of the conservation easement.

Table 9.6. Carbon in Harvested Wood Products Confirmation Items for Both Baseline and Forecasted Project Stocks.

Confirmation Items		Section of Methodology	Apply Professional Judgment?
1. **Carbon in Harvested Wood Delivered to Mills**	a. Amount of wood harvested that will be delivered to mills has been estimated and reported. b. The appropriate wood density factor has been applied and/or water weight subtracted to result in pounds of biomass with zero moisture content. c. Total dry weights for all harvested wood have been calculated. d. Total carbon weight has been computed. e. The total has been converted to metric tons of carbon.	Appendix A	No
2. **Account for Mill Efficiencies**	The correct mill efficiency factors have been used to calculate total carbon transferred into wood products.	Appendix A	No
3. **Wood Product Classification**	The percentages of harvest by wood product class has been determined correctly with confirmed reports from the mill(s) where the project area's logs are sold; or by looking up default wood product classes for the project's Assessment Area(s); or if not available from either of these sources, by classifying all wood products as "miscellaneous."	Appendix A	No
4. **Calculation of In-Use and Landfill Carbon Storage**	a. The amount of carbon stored in in-use wood products over 100 years has been calculated correctly using the worksheets referenced in Quantification Guidance. These values are summed across the entire crediting period for both the baseline and forecasted project harvesting. b. If applicable, the amount of carbon stored in landfilled wood products over 100 years has been calculated correctly using the worksheets referenced in Quantification Guidance. These values are summed across the entire crediting period for both the baseline and forecasted project harvesting.	Appendix A	No
5. **Total Average Carbon Storage in Wood Products Over 100 Years**	Total average carbon storage in wood products over 100 years for harvest volume has been calculated and reported for both the baseline and forecasted project harvesting.	Appendix A	No

9.5 Completing Confirmation

The Climate Forward Confirmation Manual provides detailed information and instructions for confirmation bodies to finalize the confirmation process. It describes completing a Confirmation Report, preparing a Confirmation Statement, submitting the necessary documents to Climate Forward, and notifying the Reserve of the project's confirmed status.

10 Glossary of Terms

Additionality	Project activities that are above and beyond "business as usual" operation, exceed the baseline characterization, and are not mandated by regulation.
Anthropogenic emissions	GHG emissions resultant from human activity that are considered to be an unnatural component of the carbon cycle (i.e., fossil fuel destruction, de-forestation, etc.).
Assessment area	A distinct forest community within geographically identified ecoregions defined by the Reserve that consists of common regulatory and political boundaries that affect forest management. The size of the assessment areas is determined by efforts to achieve optimal statistical confidence across multiple scales using U.S. Forest Service Forest Inventory and Analysis Program (FIA) plots for biomass. Maps of the assessment areas and the associated data may be found on the Climate Forward website.[22]
Carbon dioxide (CO_2)	The most common of the six primary greenhouse gases, consisting of a single carbon atom and two oxygen atoms.
CO_2-equivalent (CO_2e)	The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of warming which can be caused by different GHGs.
Confirmation	The process used to ensure that a given participant's GHG emissions or emission reductions have met the minimum quality standard and complied with the Reserve's procedures and protocols for calculating and reporting GHG emissions and emission reductions
Confirmation body	An organization or company that has been ISO-accredited and approved by the Reserve to perform GHG confirmation activities for this forecast methodology.
Conservation easement	For the purposes of this forecast methodology, a deeded title interest granted in perpetuity to an eligible land trust, with terms relating to forest management in conformance with the requirements outlined in Section 2.1. The easement must outline the general monitoring obligations of the land trust, as well as identify remedies should a violation of the terms of the easement be identified during easement monitoring.
Crediting period	The amount of time in years that project benefits can be calculated as applied to the project's baseline.
Direct emissions	GHG emissions from sources that are owned or controlled by the reporting entity.
Effective Date	The date of adoption of this methodology by the Reserve: March 24, 2020.

[22] https://climateforward.org/program/methodologies/mature-forest-management/

Eligible Land Trust	A nonprofit corporation described in sections 501(c)(3), 509(a)(1), and 170(h) of the Internal Revenue Code of 1986, as amended, and the regulations promulgated thereunder, 26 U.S.C. §§ 501(c)(3), 509(a)(1), and 170(h). Authorized to acquire and hold title to interests in real property under the laws of the state in which the project is located. An Eligible Land Trust must be accredited through the Land Trust Alliance.
Emission factor (EF)	A unique value for determining an amount of a GHG emitted for a given quantity of activity data (e.g., metric tons of carbon dioxide emitted per barrel of fossil fuel burned).
Forecasted Mitigation Unit (FMU)	The unit of mitigation credits used by the Reserve's Climate Forward Program. One FMU represents one metric ton of carbon dioxide equivalent (CO_2e) expected to be reduced or sequestered.
Forest carbon	The carbon found in forestland resulting from photosynthesis in trees and associated vegetation, historically and in the present. Forest Carbon is found in soils, litter and duff, plants and trees, both dead and alive.
Forest Owner	See description in Section 2.2.
Fossil fuel	A fuel, such as coal, oil, and natural gas, produced by the decomposition of ancient (fossilized) plants and animals.
Greenhouse gas (GHG)	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), or perfluorocarbons (PFCs).
GHG reservoir	A physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG that has been removed from the atmosphere by a GHG sink or a GHG captured from a GHG source.
GHG sink	A physical unit or process that removes GHG from the atmosphere.
GHG source	A physical unit or process that releases GHG into the atmosphere.
Global Warming Potential (GWP)	The ratio of radiative forcing (degree of warming to the atmosphere) that would result from the emission of one unit of a given GHG compared to one unit of CO_2.
Indirect emissions	Reductions in GHG emissions that occur at a location other than where the reduction activity is implemented, and/or at sources not owned or controlled by project participants.
Metric ton (t, tonne)	A common international measurement for the quantity of GHG emissions, equivalent to about 2204.6 pounds or 1.1 short tons.
Methane (CH_4)	A potent GHG with a GWP of 28, consisting of a single carbon atom and four hydrogen atoms.
Mobile combustion	Emissions from the transportation of employees, materials, products, and waste resulting from the combustion of fuels in

	company owned or controlled mobile combustion sources (e.g., cars, trucks, tractors, dozers, etc.).
Professional Forester	A professional engaged in the science and profession of forestry. A professional forester is credentialed in jurisdictions that have professional forester licensing laws and regulations. Where a jurisdiction does not have a professional forester law or regulation then a professional forester is defined as having the Certified Forester credentials managed by the Society of American Foresters (see www.certifiedforester.org).
Project Area	The area inscribed by the geographic boundaries of an MFM project, as defined following the requirements in Section 4 of this methodology. Also, the property associated with this area.
Project baseline	The level of GHG emissions, removals, and/or carbon stocks at sources, sinks or reservoirs affected by an MFM project that would have occurred under a ”business as usual” scenario. For the purposes of this protocol, a project’s baseline must be estimated following standard procedures in Section 6.
Project Implementation Report	The primary document used by a project proponent to describe how the MFM project meets eligibility requirements, quantifies carbon stock estimates, and complies with terms for additionality. It also identifies how forest management, as guided by the terms of the conservation easement, will increase carbon stocking on the project area during the crediting period.
Project proponent	An organization or individual that registers mitigation projects for the purpose of generating emission reductions or removals. In the Reserve software system, project proponents may be issued FMUs for the confirmed emission reductions or removals that their mitigation projects achieve. They can also transfer and manage FMUs.
Timber Harvest Plan	A document that addresses environmental impacts and timber harvest operations submitted to state government agencies with regulatory oversight of forestry for review. In California, Timber Harvest Plans are considered functionally equivalent to the environmental analysis and review conducted as part of California Environmental Quality Act compliance. Timber Harvest Plans must be submitted by Professional Foresters, who are also responsible for the implementation of the plan. Once approved, the document provides implementation guidelines for harvest activities.

Appendix A Quantification Guidance for MFM Projects

This appendix provides guidance for quantifying a Mature Forest Management (MFM) Project's onsite carbon stocks and carbon in harvested wood products, both for purposes of estimating a project's baseline as well as providing estimates of forecasted project carbon stocks throughout the project's crediting period.

A.1 Reporting Requirements for Forest Carbon Pools

Onsite forest carbon pools are broadly grouped into living biomass, dead biomass, and soils. Living biomass includes biomass in live trees and shrubs and herbaceous understory (live non-tree biomass). Onsite dead biomass includes biomass in dead trees, lying dead wood, and litter. Offsite dead biomass includes harvested wood products.

For standardized reporting, all estimates of forest carbon stocks must be provided in terms of metric tons (tonnes) of CO_2-equivalent (CO_2e) on a project and a per acre basis. Unless otherwise required in the referenced biomass equations, the following conversion formulae shall be used:

Base Unit	Conversion		Final Unit
Biomass	0.5 **x** biomass		Carbon
Carbon	3.667 **x** carbon	=	CO_2e
Pounds	lbs **/** 2204.6		Metric tons or tonnes (t)
Acres	0.404686 **x** acres		Hectares

Reporting requirements vary for each of the carbon pools. The estimates for the pools that are derived from sampling must meet the quality standards described later in this document. Table A.1 displays the reporting requirements for each of the carbon pools.

Table A.1. Reserve Requirements for Carbon Pool Categories and Determination of Value for Pool

Category	Carbon Pool	Reporting Status
Living Biomass	Live Trees	Required for project reporting
	Shrubs and Herbaceous Understory	Not allowed for project reporting
Onsite Dead Biomass	Standing Dead Trees	Not allowed for project reporting
	Lying Dead Wood	Not allowed for project reporting
	Litter	Not allowed for project reporting
Soil	Soil	Not allowed for project reporting
Offsite Dead Biomass	Harvested Wood Products	Required for project reporting

A.2 Guidance for Estimating Carbon in Forest Carbon Pools

This section describes requirements for the development of values for the forest carbon pools described in Table A.1. Project proponents must include an inventory methodology in the Project Implementation Report (PIR). The inventory methodology must include the required provisions identified in this section.

A.2.1 Inventory Methodologies

All inventory methodologies must be based on randomized or systematic sampling and include the minimum quality parameters described in this section for each carbon pool. Inventory methodologies must describe the process for locating sample plots. Sample plot locations may be monumented in such a way to assist in relocating them for quantification and confirmation purposes. Plot monument strategies that incorporate Global Positioning Systems (GPS) along with additional navigational strategies at close range to plot centers (that direct confirmation bodies to the precise plot location) that are resistant to weather, wildlife, and other environmental factors, can substantially reduce confirmation costs. Project proponents are advised to consider the confirmation guidance (Section 9 of the MFM methodology) associated with confirmation of sampled carbon pools (in particular, the sequential sampling guidance) prior to settling on a strategy to monument plot locations.

To increase the efficiency of both project development by project proponents and confirmation by confirmation bodies, the Reserve has developed a Standardized Inventory Methodology (SIM) that project proponents may optionally use to determine how to collect sample data. The SIM is available on the Climate Forward website[23] and draws on observations about the standards and methodologies that have performed well for registered forest carbon projects. Designed in consultation with experienced project developers, verifiers and forest mensuration experts, it was created in consideration of a variety of factors, such as being suitable for use in a variety of forest conditions, achieving consistent results in consecutive plot measurements, and minimizing ambiguity in interpretation of conditions in the field.

Additionally, the SIM was developed to be consistent with the Climate Action Reserve Inventory Tool (CARIT), an inventory management computer application that project proponents may also optionally use to manage and update their forest inventories. CARIT is available on the Climate Forward website at no cost. With CARIT, project proponents will be able to manage forest inventories and calculate timber and carbon stocking. The volume and biomass equations required by the MFM methodology are already programmed into CARIT, eliminating the need for project proponents to apply such equations on their own and ensure they are correctly applied. Additionally, CARIT generates reports that are tailored specifically to the reporting requirements of the MFM methodology.

The use of the SIM does not obligate a project proponent to use CARIT, nor does the use of CARIT obligate a project proponent to use the SIM. However, CARIT will only function properly if certain inventory standards are followed. For example, only fixed area plots may be used—variable radius plots are not allowed.

A.2.2 Requirements for Estimating Carbon in Standing Live Trees

It is required that both standing live trees be sampled.

Inventory methodologies must include a description of the process for archiving sampled data, consistent with the MFM methodology's record retention requirements, and the analytical tools that will be included in the analysis of carbon stocks. The tree lists that are developed from inventory sampling and used to expand inventory estimates to the project level must be available for confirmation review. It is acceptable for the tree list to be presented and reviewed in an electronic format, such as in a database or spreadsheet application. Table A.2 displays the requirements that all project inventory methodologies must include for standing live trees.

[23] https://climateforward.org/program/methodologies/mature-forest-management/

Table A.2. Requirements for Sampling Standing Live Trees

Species	1. All trees sampled must include a species identifier. The inventory methodology must provide a crosswalk between any codes used to identify a species and the species name the codes represent. 2. Since all trees contain carbon, the inventory methodology must indicate that the sample methodology will include all species present within the project area.
Diameter at Breast Height (DBH) Measurements	1. Inventory estimates must include all trees 5 inches DBH and larger. It is acceptable that inventory methodologies include trees with DBH less than 5 inches. 2. The location of the measurement of DBH must follow U.S. FIA sampling guidelines (can be found on the Climate Forward website). 3. Measurement precision must be no greater than the nearest inch.
Height	1. Inventory methodology must describe whether all trees on sample plots are measured for height or whether a subset of the sample plot heights is measured and regression estimators are developed for unmeasured heights. 2. Inventory methodology must describe whether height measurements describe the tree's total height or some other top height measurement (regression estimators, or published form equations, may also be used to estimate top heights from a partial height or vice versa). Where regression estimators are used for tree heights, the inventory methodology must describe the populations from which the regression estimators were acquired. 3. If site indexes for project modeling are based on site tree measurements, the inventory methodology must describe site tree selection requirements and measurement procedures. Site indexes are not required to be based on measured site trees under the MFM Methodology, though project proponents should keep in mind that a description of information sources for site indexes used for project modeling must be provided for confirmation. 4. The sampling precision for tree heights (when measured) and crown ratios must be stated in the inventory methodology. Stated acceptable precision for standard measured heights not to be greater than +/- 10 feet and for measured heights of site trees, if applicable, not to be greater than +/- 5 feet. 5. The inventory methodology must include a description of the maximum angle accepted for measuring tree heights. The stated maximum acceptable slope to the measured height shall not exceed 120 percent.
Weight (Plot Area and Forest Strata)	1. All methodologies must describe the sample plot areas used to determine which trees are included for measurement. 2. All tree lists must include a field(s) that displays the weighting of each sampled tree in order to expand the sampled tree to a per acre value. 3. Where inventories are stratified, the governing rules for stratification and stratification methodology must be described. 4. Where inventories are stratified, stratum areas must be provided at confirmation with maps and tabular outputs.
Biomass Equations	1. All projects must calculate the biomass in each tree using the biomass equations provided by the Reserve (available on the Climate Forward website). 2. The project's inventory methodology must include a list of the equations and cite the version of the Reserve's equation file from which they were copied. a. CARIT (optional) includes approved biomass equations to reduce the burden of confirmation.

Deductions for Missing Biomass	1. Live trees may have cavities, broken tops or other deformities that reduce the biomass in the trees. Therefore, the inventory methodology must include a description of how deductions are estimated to account for missing biomass. The Reserve has provided guidance below that is acceptable. Alternative methods that address deductions for missing biomass are subject to approval by the Reserve.

A.2.3 Use of Regression Equations

It is acceptable to develop carbon inventories using regression estimators to estimate tree heights. Project proponents must keep in mind that plots or (sub) populations will be randomly selected for confirmation and that regression estimators should be used where a high level of certainty can be developed from the estimators. Failure to do so will result in increased effort and cost to meet the standards of confirmation.

A.2.4 Forest Vegetation Stratification

Stratification is not required, but it may simplify confirmation and possibly lower the costs of confirmation. Where forest vegetation is stratified, inventory methodologies must describe the guidelines used for stratification. Traditional stratification decisions are usually based on species composition, forest stem size (DBH or height), and density. It is important that the stratification be relevant to sampling forest carbon. The minimum polygon size to which the stratification guidelines apply must be included in the methodology. A map of current forest strata must be included in the PIR.

A.2.5 Quantification of Carbon in Live Trees from Project Data

All projects must use the appropriate biomass equations for the assessment areas the project is located in. The required biomass equations are found on the Climate Forward website.[24] The calculation of CO_2e for each tree must be conducted in a manner that provides project estimates for:

- Whole tree biomass (roots, stump, bark, bole, top, and branches). Whole tree estimates are used to provide project totals and estimates of emissions associated with harvest activities.
- Bole biomass. The bole must be calculated when the bole portion of harvested trees are delivered to manufacturing facilities for processing. It is used as the basis for determining carbon persisting in long-term wood products.
- Aboveground portion (stump, bark, bole, top, and branches) used to compare project data to common practice statistics.

Projects outside of California, Oregon, Washington, Alaska, and Hawaii use estimators for non-bole portions of the tree referred to as the Component Ratio Method (CRM). The CRM must be used to compute the various portions of the tree mentioned above. Guidance for the use of the CRM is provided in the biomass equations section of the Climate Forward website.

Projects in California, Oregon, Washington, Alaska, and Hawaii must use the biomass equations provided on the Climate Forward website to calculate the aboveground portion of the trees. The Cairns equation (Equation A.1, Equation A.2, or Equation A.3) must be used to calculate CO_2e in the belowground portion of the trees (Cairns, Brown, Helmer, & Baumgardner,

[24] https://climateforward.org/program/methodologies/mature-forest-management/

1997) and must be applied at the plot level. The Cairns equation for the appropriate latitude for the project must be used:

Equation A.1. Belowground biomass for trees in California, Oregon, Washington (Temperate Equation for 26-50° Latitude)

BBD = exp[-0.7747 + 0.8836 x ln(ABD)]

Where,			Units
BBD	=	Belowground biomass density of standing live trees	tonnes/hectare
ABD	=	Aboveground biomass density of standing live trees	tonnes/hectare

Equation A.2. Belowground biomass for trees in Alaska (Boreal Equation for ≥51° Latitude)

BBD = exp[-0.8713 + 0.8836 x ln(ABD)]

Where,			Units
BBD	=	Belowground biomass density of standing live trees	tonnes/hectare
ABD	=	Aboveground biomass density of standing live trees	tonnes/hectare

Equation A.3. Belowground biomass for trees in Hawaii (Tropical Equation for 0-25° Latitude)

BBD = exp[-1.0587 + 0.8836 x ln(ABD)]

Where,			Units
BBD	=	Belowground biomass density of standing live trees	tonnes/hectare
ABD	=	Aboveground biomass density of standing live trees	tonnes/hectare

This estimate must be converted from biomass in tonnes per hectare to CO_2e in tonnes per acre using the conversions identified earlier in this guidance.

A.2.6 Adjustments to Standing Live Trees for Missing Volume

Standing live trees may be missing portions of the tree as the result of physical and biological disturbances. Tree biomass needs to be adjusted for missing parts to produce an improved estimate of the tree's biomass. The guidance in this section provides a standardized method to account for such biomass adjustments.

The first step is to estimate the gross biomass in the tree as if it were whole, using the biomass equations (the first step in the biomass and carbon calculations) provided on the Climate Forward website.[25] The tree's biomass is then adjusted based on the tree's 'net' biomass. To standardize, the tree is divided into four parts: top, middle, bottom (visually estimating the original disposition of the aboveground portion of the tree when it was alive and vigorous), and the belowground portion. The belowground portion must be calculated as it would for a normal, healthy tree, using the Cairn's equation. It is assumed that the belowground portion is intact and complete. The standardized percentages assumed to be in each aboveground portion of the tree are shown in Table A.3.

[25] https://climateforward.org/program/methodologies/mature-forest-management/

Table A.3. Assumed Percentages of Biomass in Each Aboveground Portion of the Tree

Tree Portion	Percent of Aboveground Tree Biomass
Top 1/3	10%
Middle 1/3	30%
Bottom 1/3	60%

An ocular estimate is made of the portion remaining in each section of the tree during field sampling. Deductions from gross volume are made for anything that reduces the tree's gross biomass, including breakage and cavities. The percentage remaining in each third is then summed to calculate the net biomass remaining in the tree, as shown in Table A.4 using a tree with a gross biomass of 0.1 tonnes CO_2e.

Table A.4. Example: Calculating Net Biomass in a Tree

Tree Portion	Percent of Tree Biomass	Gross Biomass	Percent Remaining in Tree	Net Biomass
	(from Table A.3)	(tonnes CO_2e) Percent of tree biomass **x** tree biomass		(tonnes CO_2e) Percent remaining in tree **x** gross biomass
Top 1/3	10%	10% **x** 0.1 **=** 0.01	0%	0.000
Middle 1/3	30%	30% **x** 0.1 **=** 0.03	50%	0.015
Bottom 1/3	60%	60% **x** 0.1 = 0.06	100%	0.060
Total Biomass				0.075

A.2.7 Total Onsite Carbon Stocks and Calculating the Confidence Deduction

To determine the GHG reductions and removals forecasted to be achieved by the project at the end of the crediting period, the carbon stocks in all of the relevant carbon sources, sinks, and reservoirs must be summed. The Reserve has developed an MFM Calculation Worksheet to assist in the reporting of relevant pools and calculation of FMUs. The worksheet is available on the Climate Forward website[26] in a bundle with the Harvested Wood Products Calculation Worksheet, and contains instructions for its use. The live tree pool is sampled and the mean estimate is used for reporting. The number reported for the live tree pool is adjusted based on the confidence in the estimate of the carbon. The sampling error is calculated for each of the sampled pools at the 90 percent confidence level and subsequently calculated as a percentage of the mean, using the following steps:

Step 1: Calculate the mean and the standard error[27] of the inventory estimate.

Step 2: Multiply the standard error by 1.645.

[26] https://climateforward.org/program/methodologies/mature-forest-management/

[27] Under certain circumstances, the finite population correction factor is normally required for the calculation of the standard error. As a conservative measure, Project Proponents may opt not to apply the finite population correction factor.

Step 3: Divide the result in Step 2 by the total inventory estimate and multiply by 100. This establishes the sampling error (expressed as a percentage of the mean inventory estimate from field sampling) for a 90 percent confidence level.

The per-acre unit must be expanded to the project area based on the number of acres in the project. The onsite CO_2e tonnes for the project is input into the MFM Calculation Worksheet for reporting.

A.2.7.1 Applying a Confidence Deduction to Sampled Estimates

Any forest carbon inventory derived from sampling will be subject to statistical uncertainty. Where statistical confidence is low, there is an increased risk of overestimating a project's carbon stocks and therefore a higher risk of over-quantifying GHG reductions and removals. To help ensure that estimates of GHG reductions and removals are conservative, project proponents are required to apply a confidence deduction to the inventory of onsite carbon stocks forecasted for the end of the 100-year crediting period. A confidence deduction is *not* applied to the forest carbon inventory when it is used to model baseline carbon stocks. Confidence deductions are applied, where appropriate, to estimated onsite forest carbon stocks.

The target sampling error for the inventory estimate is +/- 10 percent of the mean at the 90 percent confidence level. Projects that cannot meet this target statistic are still eligible but may have to take a "confidence deduction" that reduces their net reported carbon stocks. The sampling error must be compared to Table A.5 to determine the confidence deduction. The percent deduction from the table below is input into the calculation worksheet which calculates the net reported onsite stocks.

Table A.5. Forest Carbon Inventory Confidence Deductions Based on Level of Confidence in the Estimate Derived from Field Sampling

Sampling Error (Percent of Inventory Estimate)	Confidence Deduction
0 to 10%	0%
10.1 to 19.9%	(Sampling Error – 10%) to the nearest 1/10 percentage
20% or greater	100%

A.2.8 Requirements for Calculating Carbon in Harvested Wood Products

A portion of the carbon in harvested trees continues to be sequestered for long periods of time as wood products. Standardized guidance is provided to account for forest carbon that remains sequestered in harvested wood products. The methodology bases the accounting of harvested wood products on the average amount of carbon sequestered over a 100-year period. The 100-year period is consistent with the methodology's definition of permanence. The average amount of carbon remaining sequestered over the 100-year period is determined by calculating the amount of carbon delivered to the mills, the portion of the carbon that is converted to wood products using a coefficient that estimates the mill's efficiency, and determining the wood product classes manufactured by the mill, as different wood products have different decay rates.

An estimate of the average carbon remaining in use over the 100-year term is provided for each wood product class, which is the basis of baseline and forecasted project reporting of harvested wood products. Furthermore, some wood products eventually end up in landfills where anaerobic conditions serve to reduce the rate of further decomposition. Since the amount of

harvested wood products that end up in landfills and the actual decay rate of the wood products in landfills are highly uncertain, the accounting of harvested wood products in landfills is included only when it is conservative to do so. Conservative in this case means that if, over the 100-year crediting period, the amount of harvested wood products in the baseline exceeds the amount of harvested wood products in the project activity, the carbon in landfills is reported. If there is more harvesting of wood products in the project case than in the baseline case, harvested wood products are not considered in either the baseline or the project case.

The Reserve has developed a spreadsheet tool to assist in the calculation of harvested wood products, which is available on the Climate Forward website.[28] The Harvested Wood Products Calculation Worksheet, bundled with the MFM Calculation Worksheet, contains step by step instructions for its use. The reporting of harvested wood products is based on periodic model outputs for both the baseline and the forecasted project across the 100-year crediting period. Default mill efficiencies and wood product classes must be applied to both the baseline harvested wood products and forecasted project harvested wood products.

The spreadsheet is designed with default values for converting volumetric units from logs delivered to mills to cubic feet and default values of mill efficiencies, on a geographic basis, which must be used.

A.2.9 Leakage

Secondary effects, or leakage, reflect market responses to changes in wood product production. The general assumption in this protocol is that modifying harvest in an MFM project relative to baseline harvesting levels will lead the market to compensate via modifications to harvesting levels by other landowners. The greater the change in harvest by an MFM project relative to baseline levels, the greater the response by the market to compensate.

Market leakage effects are accounted for under MFM projects by considering the impacts of shifting activities over the entire crediting period of the project. Recognizing that secondary effects from a project may be influenced by long term harvesting trends, the evaluation in Equation 6.5 of the MFM methodology considers cumulative harvest amounts from project inception to the end of the crediting period. Although secondary effects may be negative if forecasted project harvesting is below baseline harvesting, under no circumstances shall secondary effects be positive. If forecasted project harvesting exceeds baseline harvesting, secondary effects is zero.

A.3 Modeling Carbon Stocks

This methodology requires the use of certain empirical models to estimate the baseline carbon stocks and forecasted project stocks of selected carbon pools within the project area .

A.3.1 Models and their Eligibility for Use with Forest Projects

Empirical models are used to forecast the estimations derived from direct sampling into the future. Field measurements (standing live trees) provide the base input data for these models. Project proponents should be careful to ensure that all required data inputs for the models are included in the inventory methodology.

The models that simulate growth projections provide a critical function in the development and management of an MFM project. They project the results of direct sampling through simulated

[28] https://climateforward.org/program/methodologies/mature-forest-management/

forest management activity. These models, often referred to as growth and yield simulation models, may project information regarding tree growth, harvesting, and mortality over time – values that must ultimately be converted into carbon in an additional step. Other models may combine steps and estimate tree growth and mortality, as well as changes in other carbon pools and conversions to carbon, to create estimated projections of carbon stocks over time.

The following growth models have been approved:

- CACTOS: California Conifer Timber Output Simulator
- CRYPTOS: Cooperative Redwood Yield and Timber Output Simulator
- FVS: Forest Vegetation Simulator
- FPS: Forest Projection System
- FREIGHTS: Forest Resource Inventory, Growth, and Harvest Tracking System
- CRYPTOS Emulator
- FORESEE

The Reserve may include additional models following approval of a state forestry authority (i.e., a state agency responsible for oversight of forests) who will acknowledge in writing that the model:

- Has been peer reviewed in a process that 1) primarily involved reviewers with necessary technical expertise (e.g., modeling specialists and relevant fields of biology, forestry, ecology, etc.), and 2) was open and rigorous
- Is parameterized for the specific conditions of the project area
- Limits use to the scope for which the model was developed and evaluated
- Is clearly documented with respect to the scope of the model, assumptions, known limitations, embedded hypotheses, assessment of uncertainties, and sources for equations, data sets, factors or parameters, etc.
- Underwent a sensitivity analysis to assess model behavior for the range of parameters for which the model is applied
- Is periodically reviewed

A.3.2 Using Models to Forecast Carbon Stocks

The use of simulation models is required for estimating a project's baseline and forecasted project carbon stocks.

Standing live tree information must be incorporated into the simulation models to project carbon stocks over time. If a model has the ability to convert biomass to carbon, it must include all the carbon pools required by this methodology.

Projected baseline and forecasted project carbon stocks must be portrayed in a graph depicting time in the x-axis and carbon tonnes in the y-axis. Carbon stocks must be projected forward from the project's start date. The graph should be supported with written characterizations that explain any annual changes in baseline and forecasted project carbon stocks over time. These characterizations must be consistent with the baseline and forecasted project analyses required in Section 6 of the MFM methodology.

A.3.3 Modeling Requirements

A modeling plan must be prepared that addresses all required projecting of baseline and forecasted project carbon stocks for the project. The modeling plan shall contain the following elements:

1. A description of all silviculture methods modeled for the baseline and the forecasted project. The description of each silviculture method will include:
    a. A description of the trees retained (by species groups if appropriate) at harvest.
    b. The harvest frequency (years between harvests) for each silviculture method modeled.
    c. Regeneration assumptions.
2. A list of all legal constraints that affect management activities on the project area under both the baseline and the forecasted project scenarios. This list must identify and describe the legal constraint, how the legal constraint affects the project area, and discusses the silviculture methods that will be modeled to ensure the constraint is respected.
3. A description of the site indexes used for each species, an explanation of the source of the site index values used, and a description of the adjustment made to the site index values applied to the modeling of forecasted project stocks.
4. A description of the model used and an explanation of how the model was calibrated for local use, if applicable.

Modeling outputs must include:

1. Periodic harvest, inventory, and growth estimates for the entire project area presented as total carbon tonnes and carbon tonnes per acre.

Harvest yield streams on modeled stands, averaged by silviculture method and constraints, which must include the period over which the harvest occurred and the estimated CO_2e of wood (CO_2e in logs delivered to mills) removed.