DRAFT U.S. Forest Protocol

Version 1.0

DRAFT FOR PUBLIC COMMENT

Adapted, with alterations from:
US Forest Protocol 5.1, Climate Action Reserve
US Forest Protocol 2015, California Air Resources Board

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Abbreviations and Acronyms

C	Carbon
CH_4	Methane
CO_2	Carbon dioxide
FIA	USFS Forest Inventory and Analysis
FP	Forest Protocol
GHG	Greenhouse gas
lb	Pound
IFM	Improved Forest Management
N_2O	Nitrous oxide
PF	Professional Forester, in the case of California, a “Registered Professional Forester”
PIA	Project Implementation Agreement
RPF	Registered Professional Forester, a person registered to practice professional forestry in California
USFS	United States Forest Service

1 Definitions

Aboveground Live Biomass	Live trees including the stem, branches, and leaves or needles, brush, and other woody live plants aboveground.
Activity-Based Funding	The budget line items that are dedicated to agency accomplishments in vegetation management, including pre-commercial thinning, commercial thinning, harvest, hazard tree removal, hazardous fuel reductions, and other management activities designed to achieve forest sustainability health objectives.
Affiliate	An “affiliate” is defined as any person or entity that, directly or indirectly, through one or more intermediaries, controls or is controlled by or is under common control with the Forest Owner(s) participating in a project, including any general or limited partnership in which the Forest Owner is a partner and any limited liability company in which the Forest Owner is a member. For the purposes of this definition, “control” means the possession, direct or indirect, of the power to direct or cause the direction of the management and policies of a person, whether through the ownership of voting securities, by contract or otherwise, and “person” means an individual or a general partnership, limited partnership, corporation, professional corporation, limited liability company, limited liability partnership, joint venture, trust, business trust, cooperative or association or any other legally-recognized entity.
Allometric Equation	An equation that utilizes the genotypical relationship among tree components to estimate characteristics of one tree component from another. Allometric equations allow the belowground root volume to be estimated using the aboveground bole volume.
Assessment Area	A distinct forest community within geographically identified ecoregions 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 Ecology’s website.

Avoided Conversion Project	A type of Forest Project consisting of specific actions that prevent the conversion of forestland to a non-forestland use by dedicating the land to continuous forest cover through conservation easement recordation or transfer to public ownership.
Biological Emissions	For the purposes of the Forest Protocol, biological emissions are GHG emissions that are released directly from forest biomass, both live and dead, including forest soils.
Biomass	The total mass of living organisms in a given area or volume; recently dead plant material is often included as dead biomass.[38]
Bole	A trunk or main stem of a tree.
Broadcast Fertilization	A fertilizer application technique where fertilizer is spread across the soil surface by tractor or aerial application.
Carbon Pool	A reservoir that has the ability to accumulate and store carbon or release carbon. In the case of forests, a carbon pool is the forest biomass, which can be subdivided into smaller pools. These pools may include aboveground or belowground biomass or harvested wood products, among others.
Commercial Rotational Harvesting	For the purpose of this protocol, commercial rotational harvesting refers to harvesting activities undertaken by a Forest Owner with the intent to create a new cohort of regenerated trees, where the harvested trees are delivered to a mill.
Common Practice	The average stocks of the aboveground standing live and dead carbon pools from within the Forest Project's Assessment Area, derived from FIA plots on all private lands within the defined Assessment Area.
Computational Reversal	A computational reversal is any reversal that is due to required protocol calculations (including the confidence deduction and secondary effects).

[37] Helms. (1998).
[38] Metz, Davidson, Swart, & Pan. (2001).

Even-Aged Management	Management where the trees in individual forest stands have only small differences in their ages (a single age class). By convention, the spread of ages does not differ by more than 20 percent of the intended rotation.
FIA	USDA Forest Service Forest Inventory and Analysis program. FIA is managed by the Research and Development organization within the USDA Forest Service in cooperation with State and Private Forestry and National Forest Systems. FIA has been in operation under various names (Forest Survey, Forest Inventory and Analysis) for 70 years.
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 Management	The commercial or noncommercial growing and harvesting of forests.
Forest Owner	A corporation or other legally constituted entity, city, county, state agency, individual(s), or a combination thereof that has legal control (described in Section 2.2) of any amount of forest carbon within the Project Area
Forest Project	A planned set of activities designed to increase removals of CO_2 from the atmosphere, or reduce or prevent emissions of CO_2 to the atmosphere, through increasing and/or conserving forest carbon stocks.
Forestland	Land that supports, or can support, at least ten percent tree canopy cover and that allows for management of one or more forest resources, including timber, fish and wildlife, biodiversity, water quality, recreation, aesthetics, and other public benefits.
GHG Assessment Boundary	The GHG Assessment Boundary defines all the GHG sources, sinks, and reservoirs that must be accounted for in quantifying a Forest Project's GHG reductions and removals (Section 6). The GHG Assessment Boundary encompasses all the GHG sources, sinks, and reservoirs that may be significantly affected by Forest Project activities, including forest carbon stocks, sources of biological CO_2 emissions, and mobile combustion GHG emissions.

GHG Reductions and Removals	See definitions for Reduction and Removal.
Greenhouse Gas (GHG)	Gas that contributes to global warming and climate change. For the purposes of this Forest Protocol, GHGs are the six gases identified in the Kyoto Protocol: carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
Improved Forest Management Project	A type of Forest Project involving management activities that increase carbon stocks on forested land relative to baseline levels of carbon stocks.
Listed	A Forest Project is considered "listed" when the Project Operator has created an account with the an approved Offset Project Registry and Washington State's Compliance Instrument Tracking System Service (CITSS), submitted the required Project Submittal form and other required documents, paid the project submission fee to approved offset project registry, and the offset project registry has approved and accepted the project for listing.
Litter	Any piece(s) of dead woody material from a tree, e.g., dead boles, limbs, and large root masses, on the ground in forest stands that is smaller than material identified as lying dead wood.
Lying Dead Wood	Any piece(s) of dead woody material from a tree, e.g., dead boles, limbs, and large root masses, on the ground in forest stands. Lying dead wood is all dead tree material with a minimum average diameter of five inches and a minimum length of eight feet. Anything not meeting the measurement criteria for lying dead wood will be considered litter. Stumps are not considered lying dead wood.
Metric Ton or "tonne" (t)	A common international measurement for the quantity of GHG emissions, equivalent to about 2204.6 pounds or 1.1 short tons.
Native Forest	For the purposes of this protocol native forests shall be defined as those occurring naturally in an area, as neither a direct nor indirect consequence of human activity post-dating European settlement.
Natural Forest Management	Forest management practices that promote and maintain native forests comprised of multiple ages and mixed native species at multiple landscape scales. The application of this definition, its principles, detailed definition, and implementation are discussed further in Section 3.6.2.
Non-Forest Cover	Land with a tree canopy cover of less than ten percent.

Non-Forest Land Use	An area managed for residential, commercial, or agricultural uses other than for the production of timber and other forest products, or for the maintenance of woody vegetation for such indirect benefits as protection of catchment areas, wildlife habitat, or recreation.
Non-Harvest Disturbance	Reduction in forest cover that is not a direct result of harvest, such as wildfire and insect disturbances.
Onsite Carbon Stocks	Carbon stocks in living biomass, dead biomass, and soils within the Project Area.
Primary Effects	The Forest Project's intended changes in carbon stocks, GHG emissions or removals.
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 a Forest Project, as defined following the requirements in Section 4 of this protocol. Also, the property associated with this area.
Project Life	Refers to the duration of a Forest Project and its associated monitoring and verification activities, as defined in Section 3.4.
Public Lands	Lands that are owned by a public governmental body such as a municipality, county, state or country.
Project Operator	A Forest Owner responsible for undertaking a Forest Project and registering it with the approved offset project registry and Ecology. The Forest Owner who executes the Project Implementation Agreement, as described in Section 2.2.
Qualified Conservation Easement	"Qualified Conservation Easement" means a conservation easement that explicitly refers to the requirements of the regulation and this protocol and apply to current and all subsequent forest owners for the full duration of the forest project's life. To be "qualified" for purposes of ARB's compliance offset program, the conservation easement must be granted by the owner in fee to a qualified holder of a conservation easement in accordance with the conservation easement enabling statute of the state in which the project is located; be perpetual in duration; and expressly acknowledge that ARB is a third-party beneficiary of the conservation easement with the right to enforce all obligations under the easement and all other rights and remedies, including standing as an interested party in any proceeding affecting the easement, conveyed to the holder of the easement.
Qualified Deed Restriction	A qualified deed restriction shall ensure that the Project Implementation Agreement runs with the land and applies to all current and subsequent Project Operators for the full duration of the Forest Project's minimum time commitment, as defined in Section 3.4 of this protocol, to be determined in the approved offset project registry and Ecology's reasonable discretion. A deed restriction is not "qualified" if it merely consists of a recording of the Project Implementation Agreement or a notice of the Project Implementation Agreement, as such a recording is already required by the Project Implementation Agreement.
Reduction	The avoidance or prevention of an emission of CO_2 (or other GHG). Reductions are calculated as gains in carbon stocks over time relative to a Forest Project's baseline (also see Removal).
Reforestation Project	A type of Forest Project involving the restoration of tree cover on land that currently has no, or minimal, tree cover.
Registered	A Forest Project becomes registered with an approved offset project registry when it has been verified by an Ecology approved verifier, all required documentation (see Section 8) has been submitted by the Project Operator to offset project registry final approval, and the offset project registry approves the project.

Removal	Sequestration ("removal") of CO_2 from the atmosphere caused by a Forest Project. Removals are calculated as gains in carbon stocks over time relative to a Forest Project's baseline (also see Reduction).
Reporting Period	The period of time over which a Project Operator quantifies and reports GHG reductions and removals.
Reservoir	Physical unit or component of the biosphere, geosphere or hydrosphere with the capacity to store or accumulate carbon removed from the atmosphere by a sink, or captured from a source.
Secondary Effects	Unintended changes in carbon stocks, GHG emissions, or GHG removals caused by the Forest Project.
Sequestration	The process of increasing the carbon (or other GHGs) stored in a reservoir. Biological approaches to sequestration include direct removal of CO_2 from the atmosphere through land-use changes[39] and changes in forest management.
Significant Disturbance	Any natural impact that results in a loss of least 20 percent of the aboveground live biomass that is not the result of intentional or grossly negligent acts of the Project Operator.
Sink	Physical unit or process that removes a GHG from the atmosphere.
Source	Physical unit or process that releases a GHG into the atmosphere.
Stand	An individual unit or polygon that is relatively homogeneous in terms of the carbon stocking within its borders. For live and dead trees, the determination of stand boundaries is usually based on forest vegetation attributes, such as species, size (age), and density characteristics. For soils, the determination of soil stand boundaries is made on similar soil orders.
Standing Dead Carbon Stocks	The carbon in standing dead trees. Standing dead trees include the stem, branches, roots, or section thereof, regardless of species, with minimum diameter (breast height) of five inches and a minimum height of 15 feet. Stumps are not considered standing dead stocks.
Standing Live Carbon Stocks	The carbon in the live tree pool. Live trees include the stem, branches, roots, and leaves or needles of all aboveground live biomass, regardless of species. Live trees must meet the definition of "Tree" below to be included in the quantification of a project's Standing Live Carbon Stocks and may include individual trees measuring as small as one inch in diameter at breast height.
Standing Carbon Stocks	The combined carbon of above and below ground portions of standing live and dead trees.

Secondary Effects	Unintended changes in carbon stocks, GHG emissions, or GHG removals caused by the Forest Project.
Sequestration	The process of increasing the carbon (or other GHGs) stored in a reservoir. Biological approaches to sequestration include direct removal of CO_2 from the atmosphere through land-use changes[39] and changes in forest management.
Significant Disturbance	Any natural impact that results in a loss of least 20 percent of the aboveground live biomass that is not the result of intentional or grossly negligent acts of the Project Operator.
Sink	Physical unit or process that removes a GHG from the atmosphere.
Source	Physical unit or process that releases a GHG into the atmosphere.
Stand	An individual unit or polygon that is relatively homogeneous in terms of the carbon stocking within its borders. For live and dead trees, the determination of stand boundaries is usually based on forest vegetation attributes, such as species, size (age), and density characteristics. For soils, the determination of soil stand boundaries is made on similar soil orders.
Standing Dead Carbon Stocks	The carbon in standing dead trees. Standing dead trees include the stem, branches, roots, or section thereof, regardless of species, with minimum diameter (breast height) of five inches and a minimum height of 15 feet. Stumps are not considered standing dead stocks.
Standing Live Carbon Stocks	The carbon in the live tree pool. Live trees include the stem, branches, roots, and leaves or needles of all aboveground live biomass, regardless of species. Live trees must meet the definition of “Tree” below to be included in the quantification of a project’s Standing Live Carbon Stocks and may include individual trees measuring as small as one inch in diameter at breast height.

[39] Metz, Davidson, Swart, & Pan. (2001).

Stocks (or Carbon Stocks)	The quantity of carbon contained in identified carbon pools.
Strata	Plural of stratum. The set of different groupings for a specific attribute, such as vegetation or soil.
Stratum	A group of stands that contain a similar attribute, such as vegetation or soils attributes.
Submitted	A Forest Project to be "submitted" when all of the appropriate forms have been submitted to the approved offset project registry, and the Project Operator has paid a project submission fee to the registry.
Supersection	Spatial unit comprising an "ecosection" or multiple ecosections, as defined by the USFS, based on an analysis of physical and biological components with the aim of identifying and mapping land areas that represent unique ecological regions,[40] and containing individual geographically-limited Assessment Areas, as defined by this protocol.
Tree	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.[41]
Uneven-Aged Management	Management that leads to forest stand conditions where the trees differ markedly in their ages, with trees of three or more distinct age classes either mixed or in small groups.

2 Forest Project Definitions and Requirements

The purpose of the Compliance Offset Protocol U.S. Forest Projects (protocol) is to quantify greenhouse gas emission reductions and greenhouse gas removal enhancements associated with the sequestration of carbon achieved by increasing and/or conserving forest carbon stocks.

2.1 Project Types

The following project types are eligible to register with an approved offset project registry and request an issuance of Ecology offset credits.

2.1.1 Reforestation

A Reforestation Project involves restoring tree cover on land that is not at optimal stocking levels. A Reforestation Project is only eligible if:

1. The project involves tree planting or removal of impediments to natural reforestation, on land that:
   a. Has had ten percent or less tree canopy cover for a minimum of ten years and was previously under forest cover (including potentially as far back as pre-Euro- American settlement) or is a site that is appropriate for the support of native forests, as demonstrated by corresponding evidence such as historical remote sensing-based imagery or LANDFIRE Biophysical Settings (BPS) data; or
   b. Has been subject to a Significant Disturbance that has reduced canopy cover to below 25% within the Project Area.
2. The tree planting, or removal of impediments to natural reforestation, does not follow a commercial harvest of healthy live trees that has occurred in the Project Area within the past ten years, or since the occurrence of a Significant Disturbance, whichever period is shorter.
3. The project may not include areas in which tree cover is produced or expanded in ways that result in the replacement of intact native grassland habitat within broadly recognized grassland biomes.[1]
4. The project does *not* employ broadcast fertilization.

A Reforestation Project may involve subsequent tree harvesting and other silvicultural activities. Reforestation Projects may be eligible on both private and public lands, excluding federal lands.

2.1.2 Improved Forest Management

An Improved Forest Management Project involves management activities that maintain or increase carbon stocks on forested land relative to baseline levels of carbon stocks, as defined in Section 6.2 of this protocol. An Improved Forest Management Project is only eligible if:

1. The project takes place on land that has greater than ten percent tree canopy cover.

2. The project employs natural forest management practices, as defined in Section 3.6.2 of this protocol.
3. The project may not include areas in which tree cover is produced or expanded in ways that result in the replacement of intact native grassland habitat within broadly recognized grassland biomes.
4. The project does *not* employ broadcast fertilization.

Eligible management activities may include, but are not limited to:

- Increasing the overall age of the forest by increasing rotation ages
- Increasing the forest productivity by thinning diseased and suppressed trees
- Managing competing brush and short-lived forest species
- Increasing the stocking of trees on understocked areas
- Maintaining stocks at a high level

Improved Forest Management Projects may be eligible on both private and public lands, excluding federal lands.

2.1.3 Avoided Conversion

An Avoided Conversion Project involves preventing the conversion of forestland to a non-forest land use by dedicating the land to continuous forest cover at existing or increased stocking levels through recordation of a conservation easement as described in Section 3.2.3 or transfer to public ownership. An Avoided Conversion Project is only eligible if:

1. The Project Operator can demonstrate that there is a significant threat of conversion of project land to a non-forest land use by following the requirements for establishing the project's baseline in Section 6.3 of this protocol.
2. The project may not include areas in which tree cover is produced or expanded in ways that result in the replacement of intact native grassland habitat within broadly recognized grassland biomes.
3. The project does *not* employ broadcast fertilization.

An Avoided Conversion Project may involve tree planting, harvesting, and other silvicultural activities as part of the project activity.

Avoided Conversion Projects are eligible only on lands that are privately owned prior to the project start date.

2.2 Forest Owners and Project Operators

A Forest Owner is an individual or a corporation or other legally constituted entity, city, county, state agency, or a combination thereof that has legal control of any amount of forest carbon[2] 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 protocol, through fee ownership and/or deeded encumbrances, such as conservation easements.

[2] See definition of Forest Carbon in glossary.

Multiple Forest Owners may exist with respect to a single Forest 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. However, only one fee owner may exist with respect to a single Forest Project. Any unencumbered forest carbon is assumed to be controlled by the fee owner. Individuals or entities holding mineral, gas, oil, or similar *de minimis*[3] interests in the forest carbon, are precluded from the definition of Forest Owner. Where any Forest Owner chooses to exclude the forest carbon it controls from becoming part of the Forest Project, the project's baseline must demonstrate the exclusion as a legal constraint.

The Project Operator is responsible for undertaking a Forest Project and registering it with an approved offset project registry and Ecology, and is ultimately responsible for compliance with the Forest Protocol. Furthermore, the Project Operator is responsible for identifying and managing environmental and social risks associated with the project as related to compliance with relevant legal requirements. The Project Operator must have an account with Washington's Compliance Instrument Tracking System Service (CITSS). to receive Ecology Offset Credits. A Project Operator must be one of the Forest Owners or must have an explicit legal agreement granting the right to operate the project from all other Forest Owners. In the latter case, the Project Operator must at least have fee ownership of the Project Area. The legal agreement granting the right to operate the project on behalf of the Forest Owner(s) will be subject to review and approval by Ecology.

In all cases, the Project Operator must secure an agreement from all other Forest Owners that (1) assigns authority to the Project Operator to undertake a Forest Project, subject to any conditions imposed by any of the other Forest Owners to include or disallow any carbon they control; and (2) waives any right on the part of the Forest Owners to seek damages, penalties, costs, losses, expenses, or judgments from Ecology arising from or in any way connected with the Forest Project.

Ecology maintains the right to determine which individuals or entities meet the definition of "Forest Owner."

The Project Operator may engage an independent third-party project developer to assist or consult with the Project Operator and to implement the Forest Project. All information submitted to Ecology and the approved offset project registry on behalf of the Project Operator shall reference the Project Operator, who is responsible for the accuracy and completeness of the information submitted, and for ensuring compliance with this Forest Protocol.

2.3 Forest Project Aggregation

Eligible Forest Projects[4] may be aggregated to improve cost-effectiveness while maintaining rigor in overall carbon inventory accounting. Individual Forest Projects can benefit through participation in an aggregate by meeting carbon inventory confidence standards across an aggregate, rather than within each project. This reduces the sampling intensity required within each project to meet statistical confidence requirements. Similarly, verification of aggregated projects is considered across the broader population, which reduces the verification costs to individual Project Operators participating in an aggregate. An aggregate consists of two or more individual Forest Projects enrolled with an Aggregator. For more information, please refer to the Guidelines for Aggregating Forest Projects in Appendix C

[3] *de minimis* control includes access right or ways and residential power line right of ways.

3 Eligibility Rules and Other Requirements

In addition to the definitions and requirements described in Section 2, Forest Projects must meet several other criteria and conditions to be eligible for registration with the Ecology, and must adhere to certain requirements related to their duration, crediting period, and management activities.

Section 3.1:	Project Location	*U.S., U.S. Territories (reforestation and avoided conversion only), and tribal areas*
Section 3.2:	Project Start Date	*No more than twelve months prior to project submission*
Section 3.3:	Additionality	*Exceed legal requirements* *Meet performance standard*
Section 3.4:	Permanence	*One hundred years following the issuance of Ecology Offset Credits*
Section 3.5:	Qualified Conservation Easement	*Optional*
Section 3.6:	Sustainable Harvesting and Natural Forest Management	*Ongoing compliance with the requirements for the project's assessment area(s)*

3.1 Project Location

All Forest Projects located in the United States of America are eligible to register with Ecology provided they meet all other eligibility requirements described in this protocol. Ecology may only issue offset credits to project that demonstrate direct environmental benefits (DEBs) to the state of Washington, as defined in WAC 173-446-595.

Reforestation Projects and Improved Forest Management Projects may be located on private land or on state or municipal public land, including on tribal lands.[5] Avoided Conversion Projects must be implemented on private land, unless the land is transferred to public ownership as part of the project. All projects can be transferred from private to public lands, whereby the public entity acquires all terms and conditions described in this protocol. Federal lands are ineligible to enroll in this protocol.

All projects that are on non-federal public lands as of the project's start date must be approved by the government agency or agencies responsible for management activities on the land. This approval must include an explicit approval of the project's baseline,

[5] Tribal lands are defined in WAC 173-446-020

as determined in Section 6, and must involve any public vetting processes necessary to evaluate management and policy decisions concerning the project activity.

Companion documents to the Forest Protocol contain data tables, equations, and benchmark data applicable to projects located in the United States. Ecology may add approved equations and models as they are developed in future versions of the Forest Protocol.

The methods required by this protocol for estimating baseline carbon stocks for Forest Projects cannot currently be applied outside the United States, as they rely on U.S.-specific data sets and models, particularly for Improved Forest Management Projects. Reforestation and Avoided Conversion Projects are eligible in U.S. Territories, as they do not depend on the U.S.-specific data sets mentioned above.

3.2 Offset Project Commencement

The project commencement (start date) of a Forest Project is the date on which an activity is initiated that will lead to increased GHG reductions or removals relative to the Forest Project's baseline. All forest projects must be submitted to the approve offset project registry within 12 months of their project start date.

The following sections detail actions that identify the project commencement for each project type.

3.2.1 Reforestation Project Commencement

- For a Reforestation Project, the action is the planting of trees, the removal of impediments to natural regeneration, or site preparation for the planting of trees, whichever comes first.

3.2.2 Improved Forest Management Project Commencement

For an Improved Forest Management Project, the action is initiating forest management activities that increase sequestration and/or decrease emissions relative to the baseline. The project commencement must be linked to a discrete, verifiable action that delineates a change in practice relative to the project's baseline. Project Operators may choose to identify one of the following actions:

- Recordation of a conservation easement on the Project Area. The project commencement is the date the easement was recorded.
- Transferring of property ownership (to a public or private entity). The project commencement is the date of property transfer.

- Submitting the project to an approved offset project registry. The project commencement is the date of submittal, provided that the project completes verification within 30 months of being submitted. If the project does not meet this deadline, it must be resubmitted under the latest version of the protocol; it will not retain the initial submittal date and will be subject to any new project start date requirements.

Project Operators must affirm the action denoting the project commencement by providing documentation. Adequate documentation could include deeds of trust, title reports, conservation easement documentation, dated forest management plans, and/or contracts or agreements.

3.2.3 Avoided Conversion Project Commencement

For an Avoided Conversion Project, the project commencement must be linked to a discrete, verifiable action that signifies the commitment of the Project Area to continued forest management and protection. The Project Operator may choose to identify one of the following actions:

- Recordation of a conservation easement with a minimum term length extending 100 years beyond final offset issuance and with a provision to maintain the Project Area in forest cover.
- Submitting a project on privately owned lands to an approved offset project registry. The project commencement is the date of submittal, provided the project completes verification within 30 months of being submitted and a conservation easement with a minimum term length extending 100 years beyond final offset issuance and with a provision to maintain the Project Area in forest cover is recorded prior to project registration and offset issuance. If the project does not meet the verification deadline, it must be resubmitted under the latest version of the protocol; it will not retain the initial submittal date and will be subject to any new project start date requirements.
- Transferring the Project Area to public ownership where the Project Area will be maintained in forest cover.
- Where recordation of a conservation easement or submission of a project on private lands with subsequent recordation of a conservation easement is used to signal the project commencement, multiple conservation easements may be used to cover a single Project Area. Where transfer of the Project Area to public ownership is used to signal the project start date, multiple transfers may be used to cover a single Project Area. In either case, the following provisions must be met, as applicable:

- The Project Area being placed under easements has one common fee owner, as required by Section 2.2, or the Project Area is being transferred to a single public entity;
- The easements must all have been recorded within the span of 12 months, or the transfers all take place within the span of 12 months;
- The alternative non-forest land use being avoided must be identical for all portions of the project and the default rate of conversion must be used (see Table 6.4); and,
- The Conversion Risk Adjustment Factor must be the same for all portions of the project (see Equation 6.14).

[7] Submitting a project to an approved offset project registry and Ecology is considered an initiation of a commitment to employ practices that will maintain or grow net carbon stocks for the duration of the FP's commitment period,

In these cases, the project start date may be the date the project is submitted to an approved offset project registry, the date of the last recorded easement, or the date of the final transfer of land.

3.3 Additionality

Offset credits issued by Ecology must reflect greenhouse gas emission reductions or removals that exceed any greenhouse gas reduction or removals otherwise required by law, regulation or legally binding mandate, and that exceed any greenhouse gas reductions or removals that would otherwise occur in a business-as-usual scenario, as defined in WAC 173-446-020.

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

- On-site 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[8] or between entities owning forests as a financial investment.[9]
- Over the length of a project lifetime and in the absence of a long-term commitment to a Forest Project, emissions may have resulted from the clearing of trees to convert a forest to another land cover type (for avoided conversion projects) or from harvest activities that reduce average on-site carbon stocking (for improved forest management projects).
- Committing a site to a Forest Project for at least 100 years and the long-term requirements specified in this protocol (e.g., monitoring, reporting, and verification; compensation for reversals; buffer pool contributions) removes such risks to emissions.

Furthermore, this protocol 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 100-year project life, during which project activities ensure forest carbon stocks are maintained or increase compared to the baseline, since the precise timing of potential outcomes within the counterfactual scenario are impossible to pinpoint. This and other assumptions incorporated into the quantification of a project's baseline and GHG reductions, as described below in Section 6, are used to create more consistency and simplicity in crediting while maintaining conservativeness. The offset crediting period is defined in WAC 173-446-505(2). The crediting period is 25 years for reforestation and avoided conversion projects and 10 reporting periods for improved forest management projects. Forest Projects must satisfy the following tests to be considered additional:

[8] 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.
[9] 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.

1. *Legal Requirement Test*. Forest Projects must achieve GHG reductions or removals above and beyond any GHG reductions or removals that would result from compliance with any federal, state, or local law, statute, rule, regulation, or ordinance. Forest Projects must also achieve GHG reductions and removals above and beyond any GHG reductions or removals that would result from compliance with any court order or other legally binding mandates including management plans (such as Timber Harvest Plans) that are required for government agency approval of harvest activities.

   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, unless they are recorded within a year of the Forest Project's start date with clear agreement from all Forest Owners.

   Deeded encumbrances may contain terms that do not directly refer to forest carbon, but that nevertheless restrict the effect the ability of any one Forest Owner to change 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:

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

2. *Performance Test*. Forest Projects must achieve GHG reductions or removals above and beyond any GHG reductions or removals that would result from engaging in Business As Usual activities, as defined by the requirements described below (Section 3.3.2).

   Project quantification (Section 6) further ensures that forest projects are additional via checks on financial feasibility.

3.3.1 Legal Requirement Test

The legal requirement test is satisfied if the following requirements are met, depending on the type of Forest Project.

3.3.1.1 Reforestation Projects

A project's final baseline must reflect all legal constraints, as required in Section 6.1.1 of this protocol.

3.3.1.2 Improved Forest Management Projects

A project's final baseline must reflect all legal constraints in effect at the time of the project's start date, as required in Section 6.2 of this protocol.

3.3.1.3 Avoided Conversion Projects

Avoided conversion projects must demonstrate that the following requirements are met to satisfy the legal requirement test:

(1) Project activities are not legally required (as defined in subchapter 2.3) at the time of offset project commencement; and

(2) Modeling of the forest project's baseline carbon stocks reflects all legal constraints (as required in subchapter 5 and appendix B).

(3) Avoided conversion projects submit official documentation demonstrating that the type of anticipated land use conversion is legally permissible. Such documentation must fall into at least one of the following categories:

(A) Documentation indicating that the current land use policies, including zoning and general plan ordinances, and other local and state statutes and regulations, permit the anticipated type of conversion;

(B) Documentation indicating that the forest owner(s) obtained all necessary approvals from the governing county to convert the project area to the proposed type of non-forest land use (including, for instance, certificates of compliance, subdivision approvals, timber conversion permits, other rezoning, major or minor use permits, etc.); or

(C) Documentation indicating that similarly situated forestlands within the project's assessment area were recently able to obtain all necessary approvals from the governing county, state, or other governing agency to convert to a non-forest land use (including, for instance, certificates of compliance, subdivision approvals, timber conversion permits, other rezoning, major or minor use permits, etc.).

A project's final baseline must reflect all legal constraints, as required in Section 6.3 of this protocol.

3.3.2 Performance Test

The performance test is satisfied if the following requirements are met, depending on the type of Forest Project.

3.3.2.1 Reforestation Projects

A Reforestation Project that occurs on land that has had ten percent or less tree canopy cover for at least ten years automatically satisfies the performance test.

A Reforestation Project that occurs on land that has undergone a Significant Disturbance satisfies the performance test if the Forest Project satisfies the requirement that the Significant Disturbance occurred within the past 10 years and decreased the live tree canopy cover below 25 percent.

3.3.2.2 Improved Forest Management Projects

An Improved Forest Management Project automatically satisfies the performance test. Project activities are considered additional to the extent they produce GHG reductions and/or removals in excess of those that would have occurred under a business-as-usual scenario, as defined by the baseline estimation requirements in Section 6.2.

3.3.2.3 Avoided Conversion Projects

An Avoided Conversion Project satisfies the performance test if the Project Operator provides two real estate appraisals for the Project Area (as defined in Section 4) indicating the following:

1. *The Project Area is suitable for conversion*. The appraisals must clearly identify the highest value alternative land use for the Project Area and indicate how the physical characteristics of the Project Area are suitable for the alternative land use.
2. The appraisals must conform with the following minimum standards adapted from Sections 5096.501 and 5096.517, Public Resources Code, State of California.
    a. Appraisal reports shall be prepared and signed by Licensed or Certified Real Estate Appraisers in good standing.

b. Appraisal reports shall include descriptive photographs and maps of sufficient quality and detail to depict the subject property and any market data relied upon, including the relationship between the location of the subject property and the market data.
c. Appraisal reports shall include a complete description of the subject property land, site characteristics and improvements. Valuations based on a property's development potential shall include:

i. Verifiable data on the development potential of the land (e.g., Certificates of Compliance, Tentative Map, Final Map).
ii. A description of what would be required for a development project to proceed (e.g., legal entitlements, infrastructure).
iii. Presentation of evidence that sufficient demand exists, or is likely to exist in the future, to provide market support for the development.
iv. Where conversion to commercial, residential, or agricultural land uses is identified as the highest value alternative land use, the appraisal(s) must demonstrate that the slope of Project Area land is compatible with the alternative land use by identifying two areas with similar average slope conditions to the Project Area that have been converted within the past ten years in the project's Assessment Area. Alternatively, the Project Area must have an average slope less than 40 percent.
v. Where conversion to agricultural land use is anticipated, the appraisal(s) must provide:

1) Evidence of soil suitability for the type of expected agricultural land use.
2) Evidence of water availability for the type of expected agricultural land use.
3) Where conversion to mining land use is anticipated, the appraisals must provide evidence of the extent and amount of mineral resources existing in the Project Area.

vi. Where conversion to residential, commercial, or recreational land uses is anticipated, the appraisals must also describe the following information:

1) The proximity of the Project Area to metropolitan areas
2) The proximity of the Project Area to grocery and fuel services and accessibility of those services
3) Population growth within 180 miles of the Project Area

d. Appraisal reports shall include a statement by the appraiser indicating to what extent land title conditions were investigated and considered in the analysis and value conclusion.
e. Appraisal reports shall include a discussion of implied dedication, prescriptive rights or other unrecorded rights that may affect value, indicating the extent of investigation, knowledge, or observation of conditions that might indicate evidence of public use.
f. Appraisal reports shall include a separate valuation for ongoing forest management prepared and signed by a certified or registered professional forester. This valuation shall be reviewed and approved by a second qualified, certified or registered professional forester, considered by the appraiser, and appended to the appraisal report(s). The valuation must identify and incorporate all legal constraints that could affect the valuation of both the ongoing forest management.

g. The appraisals must provide a map that displays specific portions of the Project Area that are suitable for the identified alternative land use. (For example, an appraisal that identified a golf course as an alternative land use must specify the approximate acres suitable for fairways, greens, clubhouses, and outbuildings.). The smaller of the two areas identified in the appraisals must be used.
h. The two appraisals must be completed by qualified appraisers who are not employed by or affiliated with the same firm.

3. *The alternative land use for the Project Area has a higher market value than maintaining the Project Area for sustainable forest management.* The appraisals for the property must provide a value for the current forest land use condition of the Project Area and a fair market value of the anticipated alternative land use for the Project Area. The anticipated alternative land use for the Project Area from the lower of the two appraisals must be at least 40 percent greater than the value of the current forested land use.

   The appraisals must be conducted in accordance with the Uniform Standards of Professional Appraisal Practice and the appraisers must meet the qualification standards outlined in the Internal Revenue Code, Section 170 (f)(11)(E)(ii).

3.3.3 Enhancement Payments

Enhancement payments provide financial assistance to landowners in order to implement discrete practices that address natural resource concerns and deliver environmental benefits. Examples of relevant enhancement payments include:

- Climate Commitment Act funds – including funds from the Climate Investment Account, the Climate Commitment Account, or the Natural Climate Solutions Account
- USFS grants and agreements

Forest Owner(s) may pursue enhancement payments that support forest carbon project activities. Because every available enhancement payment is not comprehensively addressed by the protocol at this time, the Forest Owner(s) must still disclose any such payments to the verifier, the approved offset project registry and Ecology on an ongoing basis. Ecology maintains the right to determine if payment stacking has occurred and whether or not it would impact project eligibility or baseline setting.

3.4 Permanence

Project Operators must monitor and verify a Forest Project for a period of 100 years following the issuance of offsets for GHG reductions or removals achieved by the project. For example, if offsets are issued to a Forest Project in year 99 following its start date, monitoring and verification activities must be maintained until year 199. All Forest Projects must undergo an initial site visit verification to register with the Ecology. After the initial verification, all Forest Projects must undergo a site visit verification at the interval required in Section 7.3. The only exception to this rule is for Reforestation Projects, which may defer a second site visit verification beyond six years, at the Project Operator’s discretion. The third and subsequent site visit verifications for Reforestation Projects must continue at the interval otherwise described for all projects in Section 7.3.

There are three possible exceptions to this minimum time commitment:

1. A Forest Project automatically terminates if a Significant Disturbance occurs,[13] leading to an Unintentional Reversal that reduces the project's standing live tree carbon stocks below the project's baseline standing live tree carbon stocks. Once a Forest Project terminates in this manner, the Project Operator has no further obligations to Ecology
2. A Forest Project may be voluntarily terminated prior to the end of its minimum time commitment if the Project Operator surrenders a quantity of offsets, as specified under 'Retiring Offsets Following Project Termination' below.
3. A Forest Project may be automatically terminated if there is a breach of certain terms described within the Project Implementation Agreement. Such a termination will require the Project Operator to retire a quantity of offsets, as specified under 'Retiring offsets Following Project Termination' below.

Retiring Offsets Following Project Termination

1. For a Reforestation or an Avoided Conversion Project, the Project Operator must surrender a quantity of compliance instruments equal to the total number of Ecology Offset credits issued to the project over the preceding 100 years.
2. For an Improved Forest Management Project, the Project Operator must surrender a quantity of compliance instruments equal to the total number of Ecology Offset credits issued to the project over the preceding 100 years, multiplied by the appropriate compensation rate indicated in Table 3.1.
3. For any project seeking to terminate project activities on only a portion of the project area, the change must be treated as a potential Intentional Reversal. If it is determined that the revision to the project area would lead to an Intentional Reversal, then credits must be cancelled as described in WAC 173-446-570. Improved Forest Management projects must also apply the early termination compensation rate in Table 3.1 below. If the revision to the project area would lower standing live carbon stocks below baseline levels, then this will be considered a complete project termination.

Table 3.1. Compensation Rate for Terminated Improved Forest Management Projects

Number of Years that have Elapsed Between the Start Date and the Date of Termination	Compensation Rate
0-5	1.40
6-10	1.20
11-20	1.15
21-30	1.10
31-50	1.05
>50	1.00

[13] The natural disturbance shall not be the result of intentional or grossly negligent acts of any of the Forest Owners.

3.5 Use of Qualified Conservation Easements

A Qualified Conservation Easement is a conservation easement that meets the definition of Qualified Conservation Easement (QCE) in the Glossary.

Qualified Conservation Easements or Qualified Deed Restrictions may be voluntarily employed with any project type. Projects that choose to employ Qualified Conservation Easements have reduced obligations to Ecology's Buffer Pool, as described in Section 7 and Appendix A.

Qualified Conservation Easements must be recorded no earlier than one year before a project's start date. If a Qualified Conservation Easement was recorded more than one year prior to the start date, the limits imposed by the easement on forest management activities must be considered as a legal mandate for the purpose of satisfying the legal requirement test for additionality (Section 3.3) and in determining the project's baseline (Section 6).

3.6 Sustainable Harvesting and Natural Forest Management Practices

Forest 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 protocol, Forest Projects must:

1. Employ sustainable long-term harvesting practices, both within their Project Area and on other forest landholdings controlled by the Project Operator and its Affiliate(s) within the project's Assessment Area(s), as described in Section 3.4. Forest landholdings are considered "controlled" by the Project Operator if the Project Operator owns the land in fee or has been deeded timber rights on it.
2. Employ Natural Forest Management practices within the Project Area, including meeting species composition, forest structure, and age and habitat distribution requirements, as described in Section 3.6.2.
3. Maintain or increase standing live carbon stocks over the project life, as described in Section 3.6.3.

3.6.1 Sustainable Harvesting Practices

At the time Commercial Rotational Harvesting is initiated on any of the forest landholdings controlled by the Project Operator and its Affiliate(s) within the project's Assessment Area(s), the Project Operator and its Affiliate(s) must employ and demonstrate sustainable long-term harvesting practices on all of its forest landholdings within the project's Supersection(s), including the Project Area, using one of the following options:

1. Certification under the Forest Stewardship Council, Sustainable Forestry Initiative, or Tree Farm System certification programs. Regardless of the program, the terms of certification must require adherence to and verification of harvest levels which can be permanently sustained over time.
2. Adherence to a renewable long-term (50 years minimum) management plan that demonstrates harvest levels which can be permanently sustained over time and that is sanctioned and monitored by a state agency.
3. The use of silvicultural practices (if harvesting occurs) that maintain canopy cover averaging at least 40 percent, as measured on any 20 acres of the Project Operator's and its Affiliate(s') landholdings within the project's Supersections(s), including the Project

Area. Exceptions may be granted by Ecology where it can be demonstrated that the harvest openings are intended to restore plantations to forest conditions with greater species diversity. The Project Operator is not responsible for harvest openings that preceded their ownership if the previous ownership had no direct business affiliation with the current ownership.

4. Adherence to a deeded conservation easement(s) with terms that ensure growth equals or exceeds harvest over time.

   This requirement shall be met always during the project life and is assessed at each site visit verification.

   Project Operators and their Affiliate(s) who acquire new forest landholdings within the project's Assessment Area(s) have up to five years to incorporate such acquisitions under their certification or management plan, or otherwise must abide immediately by the terms of the Sustainable Harvesting Practices, whether or not such land is contiguous with the Project Area.

3.6.2 Natural Forest Management

All Forest Projects must promote and maintain a diversity of native species and utilize management practices that promote and maintain native forests comprised of multiple ages and mixed native species within the Project Area and at multiple landscape scales ("Natural Forest Management").

The following key requirements shall apply to all Forest Projects regardless of the silvicultural or regeneration methods that are used to manage or maintain the forest:

1. Forest Projects must show verified progress (verified at scheduled site visit verifications) towards native tree species composition and distribution requirements described below, consistent with the forest type and forest soils native to the Assessment Area.
2. Forest Projects must manage the distribution of habitat/age classes and structural elements, as described below, to support functional habitat for locally native plant and wildlife species naturally occurring in the Project Area.

   Forest Projects must incorporate the criteria for Natural Forest Management throughout the project life. The information provided in Table 3.3 shall be used to determine if the Forest Project meets the criteria for engaging in Natural Forest Management. This evaluation must be completed and verified at a Forest Project's initial verification and at all subsequent verifications. Forest Project carbon stock inventories (requirements for which are found in Appendix B) should be used as the basis of these assessments where applicable. Forest Projects that do not initially meet Natural Forest Management criteria but can demonstrate progress towards meeting these criteria at the times identified in Table 3.3 are compliant with the protocol.

1. Species Composition

All Forest Projects are required to establish and/or maintain forest types that are native to the Project Area. For the purposes of this protocol, native forests are defined as those forests occurring naturally in an area, as neither a direct nor indirect consequence of human activity post-dating European settlement, and are based on reference metrics for each Assessment Area provided in an Assessment Area Data File, a companion document to the protocol available on Ecology's website. The planting of native species outside of their current distribution is allowed up to 5% of the overall native species requirement as an adaptation strategy due to climate change. Plantings that will result in more than 5% of native species from beyond their current distribution must be done in accordance with a state or federally approved adaptation plan, or a local plan that has gone through a

transparent public review process. In all cases, the Project Operator must obtain a written statement from the government agency in charge of forestry regulation in the state where the project is located stipulating that the planting of native trees outside their current range is appropriate as an adaptation to climate change. The specifications for meeting the requirements for species composition are included in Table 3.3.

2. Forest Structure

A variety of silvicultural practices may be employed in the Project Area during the course of a Forest Project, though the protocol does not endorse any particular practice. Any practices employed, however, must meet a minimum set of standards to ensure environmental integrity associated with a balanced distribution of age and habitat classes across the landscape, as well as certain structural elements within the forest. Harvesting may be conducted within forest projects using a variety of silviculture methods. However, to ensure harvest practices maintain habitat refugia, even-aged rotations are limited to the following guidelines in Table 3.2.

Table 3.2. Even-Aged Management Retention Guidelines

Harvest Retention (Square Feet Basal Area/Acre of All Species)	**Maximum Size of Harvest Block** (Acres)
0	40
>= 15 < 20	60
>=20 < 25	80
>=25 < 30	120
>= 30 < 40	400
>= 40 < 50	600
>=50	Unlimited

Harvest retention is evaluated based on conditions immediately following harvest. Up to 10% of the harvest retention standard may be met with standing dead trees. Where any harvest occurs in harvest blocks where the harvest retention is less than 50 square feet of basal area per acre, additional harvesting may only occur within 300 feet of the harvest area (with less than 50 square feet basal area per acre) if the harvest retention of the additional harvest exceeds 50 square feet of basal area per acre. This requirement shall remain in place until the regeneration within the original harvested area (i.e., with retention less than 50 square feet basal area per acre) achieves a height of five feet or is five years old.On a watershed scale up to 10,000 acres, all projects must maintain, or make progress toward maintaining, no more than 40 percent of their forested acres in ages less than 20 years. Areas impacted by a Significant Disturbance are exempt from this test until 20 years after reforestation of such areas.

The protocol does not override a landowner's obligation to abide by applicable laws and regulations, including any governing forest practice rules that may be more stringent. Projects in Washington State must comply with Washington's Forest Practice Rules (Title 222 WAC), as applicable. Regardless of the silvicultural practice employed, landowners must fulfill their commitment under the protocol to permanently maintain or increase onsite standing live carbon stocks (i.e., the carbon in live trees within the Project Area) as specified in Section 3.6.3.

Structural elements such as standing dead trees and lying dead wood are features typically found in natural forests. They provide a variety of benefits, including wildlife habitat. Management of Forest Projects must ensure that standing dead trees and lying dead wood are present on the Project Area at certain minimum levels in accordance with the requirements outlined in Table 3.3.

Table 3.3. Evaluation Criteria to Test if a Forest Project Meets the Requirement for the Establishment and Maintenance of Native Species and Natural Forest Management

Criteria	Assessment	Application Rules
Native Species		
Project consists of at least 95% native species or demonstrates continuous progress over 50 years toward 95% native species. The assessment shall be conducted using estimates of stems per acre for Reforestation Projects for the first 12 years of a reforestation project and basal area per acre for Improved Forest Management and Avoided Conversion Projects, and for Reforestation Projects after the first 12 years, based on the inventory of carbon in standing live trees.	Assessed at initial verification from inventory data. Assessment during site visit verifications must demonstrate continuous compliance with goal (if already met) or continuous progress toward the goal (if not yet met).	Applies to all project types throughout the project life. The project is not eligible for crediting if this criterion is not met within 50 years.
Composition of Native Species		
Improved Forest Management, Avoided Conversion Projects, and Reforestation Projects older than 12 years. No single species' prevalence in a given Assessment Area, measured as the percent of the basal area of all live trees in that Assessment Area, exceeds the percentage value shown under the heading 'Composition of Native Species' in the Assessment Area Data File. **Early Reforestation (Less than 12 years)** To the extent seed is available, and/or physical site characteristics permit, Reforestation Projects must achieve a mixture of native species with no single species' prevalence, measured as the percent of all live tree stems in the Project Area, exceeds the percentage value shown under the heading 'Composition of Native Species' in the Assessment Area table in the Assessment Area Data File. **All Projects** Where portions of the Project Area naturally consist of a single species' dominance, and is inconsistent with the percentage value in the Assessment Area Data File, the Project Operator may obtain a letter from the State Forester or their representative stating that the Project Area's species diversity is reflective of background natural species diversity (despite any inconsistencies with the Assessment Area Data File). Projects must show continuous progress toward criteria. These criteria must be met within 50 years, except in cases where a variance has been granted at the initial verification, a Significant Disturbance has impacted species diversity, or natural mortality takes a project out of compliance	Species composition is assessed at initial verification from inventory data. Species composition is also assessed during the project at each site visit verification.	Applies to all project types throughout the project life. The project is not eligible for crediting if the criterion is not met within 50 years(excluding the aforementioned exceptions).

Criteria	Assessment	Application Rules
Distribution of Age Classes		
On a watershed scale up to 10,000 acres (or the Project Area, whichever is smaller), all projects must maintain, or make progress toward maintaining, no more than 40 percent of their forested acres in ages less than 20 years. (Areas impacted by Significant Disturbance may be excluded from this test.) Applies to all project types at first Commercial Rotational Harvest. Project must show continuous progress toward criterion. This criterion must be met within 25 years	Age classes are assessed during project life at each site visit verification.	The project is not eligible for crediting if the criterion is not met within 25 years.

Criteria	Assessment	Application Rules
Structural Elements (Standing and Lying Dead Wood)		
Project Operators must ensure that dead wood is recruited and maintained in sufficient quantities, as described below. **Option I**. Monitoring dead wood throughout Project Area. Project Operators may maintain inventories of lying dead wood as part of their normal inventory processes. Where inventory measurements are used to demonstrate compliance with this requirement, monumented plots or line transects must be used so the plot data can be verified. Dead wood measurements must achieve a minimum statistical confidence of +/- 30% at 1 Standard Error. The combination of standing dead and lying dead wood shall be retained at average per acre values at quantity levels identified in the Assessment Area data file. If dead material does not exist at the quantities identified in the Assessment Area data file, dead trees shall be recruited as described below for Option II. **Option II**: Monitoring dead wood on harvested areas. The assessment of sufficient lying and standing dead material shall be made in areas harvested since the last site verification. **For portions of the Project Area that have been harvested under normal circumstances (not salvage harvested):** The combination of standing dead and lying dead wood shall be retained at average per acre values at quantity levels identified in the Assessment Area data file within each harvested unit. If dead material does not exist at the required levels within the harvest units, live trees shall be retained and tagged with aluminum tags at three times the amount identified in the Assessment Area data file minus whatever quantity does exist within each harvest unit. **For portions of the Project Area that have been salvage harvested:** The combination of standing dead and lying dead wood shall be retained at a combined four tonnes per acre on average within each harvest unit. Verification that the requirement has been met shall be conducted using the methodology for verification of dead material transects found in Appendix B **Option III:** No harvesting Projects without any harvesting activities within the project area do not need to monitor specifically for structural elements.	Assessed during project at each site visit verification.	Applies to all project types throughout the project life. If not met within 25 years, the project is not eligible for crediting until the areas verified since the previous site- verification meet the requirement.

3.6.3 Promotion of the Onsite Standing Live Carbon Stocks

To promote and maintain the environmental benefits of Forest Projects, Ecology requires that the standing live carbon stocks within the Project Area be maintained and/or increased during the project life. Therefore, except as specified below, Ecology will not issue offsets for quantified GHG reductions and removals achieved by a Forest Project if the Forest Project's monitoring reports – over any ten-year consecutive period – indicate a decrease in the standing live carbon stocks.

Exceptions to this policy are allowed where reductions in standing live carbon stocks are important for maintaining and enhancing forest health, environmental co-benefits, or the long- term security of all carbon stocks; where reductions are due to non-harvest disturbances; or where reductions are required by law. Note that these exceptions in no way change or affect Ecology's policies and requirements related to compensating for reversals as detailed in WAC 173-446-570.

Forest Project standing live carbon stocks that have decreased over a ten-year period may continue to receive offsets issued by the Ecology for verified GHG reductions and removals if, and only if, the decrease in standing live carbon stocks is due to one of the following causes:

1. The decrease is demonstrably necessary to substantially improve the Project Area's resistance to wildfire, insect, or disease risks. The Project Operator must document the risks and the actions that will be taken to reduce the risks. The techniques used to improve resistance must be supported by relevant published peer reviewed research or professionally-accepted standards.
2. The decrease is associated with a planned balancing of age classes (regeneration, sub-merchantable, and merchantable) and is detailed in a long term environmentally responsible management plan. The Project Operator must demonstrate, using documentation submitted to the approved offset project registry at the time of the Forest Project's registration, that the balancing of age classes, resulting in a decrease in the standing live carbon stocks, was planned at the initiation of the Forest Project.
3. The decrease is part of normal silviculture cycles for forest ownerships less than 1,000 acres. Inventory fluctuations are a normal part of silvicultural activities. Periodic harvest may remove more biomass than the biomass growth over the past several years. At no time shall the Forest Project's inventory of carbon in the standing live carbon stocks fall below the Forest Project's baseline carbon stock estimates for the standing live carbon stocks, or 20 percent less than the Forest Project's standing live carbon stocks at the project's initiation, whichever is higher. Documentation submitted to the approved offset project registry at the time the Forest Project is registered must indicate that fluctuations in the Forest Project's standing live carbon stocks are an anticipated silvicultural activity and that the overall trend will be for standing live carbon stocks to increase or stay the same over the life of the project (Figure 3.1).

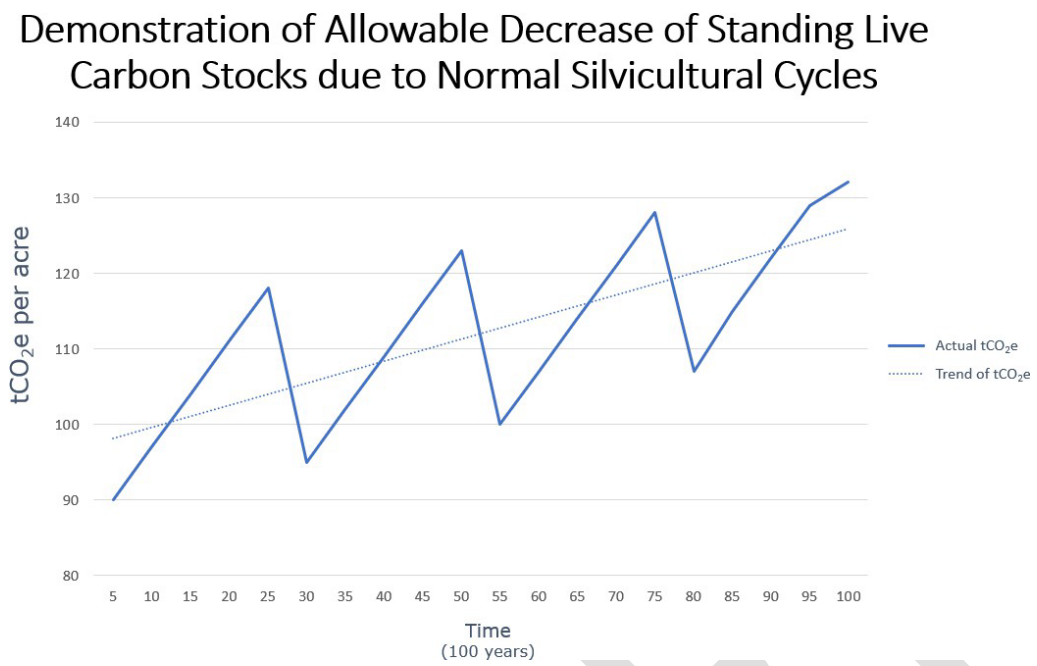


Figure 3.1. Example of Allowable Decrease of Standing Live Carbon Stocks due to Normal Silviculture Cycles

4. The decrease is part of a non-harvest disturbance, including wildfire, disease, flooding, wind-throw, insect infestation, landslides, or as otherwise approved by the Ecology.

3.7 Prior Registration in Voluntary and Compliance Offset Markets

Projects may not take place on land that was part of a previously registered compliance offset forest project, unless the previous forest project was terminated due to an unintentional reversal.

If project lands were included in a carbon offset project in a voluntary offset program the project must:

(A) Demonstrate that it has met all legal and contractual requirements to allow it to terminate its project relationship with the voluntary offset program and be listed using this compliance offset protocol;

(B) Demonstrate that all credits issued or to be issued under the voluntary offset program have been actualized prior to the compliance project start date; and

(C) Determine a baseline per the requirements of the protocol that incorporates the management practices, constraints and resulting forest conditions, at the time the offset project transitions to the Compliance Offset Protocol, as a result of participating in the voluntary offset program.

4 Identifying the Project Area

The geographic boundaries defining the project area must be described in detail at the time a Forest Project is listed with Ecology and the approved offset project 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 Operators must determine the Supersection(s) within which the Project Area is located by consulting maps of Supersections provided on Ecology's website. These maps are available as both PDF files and as a Geographical Information System (GIS) file. Once a project's Supersection(s) has been identified, 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. Ecology 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.

Geographical Information System (GIS) files depicting the Project Area must be submitted to the approved offset project with the project. The files must be submitted in both shapefile and KML file formats. Additionally, the current assessor's parcel identification numbers associated with the project area must be submitted to the approved offset project registry.

Reforestation Projects may submit a provisional project boundary that must be amended to the actual areas reforested within the provisional project boundary by the second site visit verification. For Avoided Conversion Projects, the Project Area is defined through the required appraisal process. The Project Area must be determined following the guidance in Table 4.1 based on the type of anticipated conversion.

Table 4.1. Project Area Definition for Avoided Conversion Projects

Conversion Type	Project Area Definition
Residential	The boundary of the parcel or parcels that have been appraised as having a 'higher and better use' in residential development.
Mining/Agricultural Conversion	The boundary of the parcel or parcels that have been appraised as having a 'higher and better use' in mining or agricultural production.
Golf Course	The boundary of the parcel or parcels that have been appraised as having a 'higher and better use' as a golf course. This is to include forested areas within 200 feet of fairways, greens, and buildings.
Commercial Buildings	The boundary of the parcel or parcels that have been appraised as having a 'higher and better use' in commercial buildings. This is to include forested areas with 200 feet of suitable building sites.

4.1 Project Configuration and Limitations

To ensure Project Areas are representative of the Forest Owners' general forest management, Improved Forest Management 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.[17] Exceptions may be provided if approved by Ecology or the approved offset project registry.. Non-forested areas (brush, rocks, range, etc.) may be excluded from all project types. For Improved Forest Management Projects, areas not under forest management may also be excluded from the Project Area. For all project types, 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 offset project data report..

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 verifier that GIS acres are based on recorded surveyed corners and correctly referenced with GPS

4.3 Modifying the Project Area

It is possible for project activities to be terminated on a portion of the Project Area. These adjustments must be treated as Intentional Reversals, as described in Section 3.4. If a project proceeds with terminating the project on a portion of the Project Area, a new KML file must be provided to reflect the new Project Area. An addendum to the Offset Project Data Report must also be submitted to reflect this change. The inventory for the modified Project Area will be assessed during the next regularly scheduled site visit verification, unless it is determined that an Intentional Reversal has taken place, in which case the reversal must be compensated per WAC 173-446-570.

[17] The National Hydrography Dataset can be accessed via the USGS website: http://nhd.usgs.gov/.

5 GHG Assessment Boundary

The GHG Assessment Boundary defines all the GHG sources, sinks, and reservoirs that must be accounted for in quantifying a Forest Project's GHG reductions and removals (Section 6). The GHG Assessment Boundary encompasses all the GHG sources, sinks, and reservoirs that may be significantly affected by Forest Project activities, including forest carbon stocks, sources of biological CO_2 emissions, and mobile combustion GHG emissions. For accounting purposes, the sources, sinks, and reservoirs included in the GHG Assessment Boundary are organized according to whether they are predominantly associated with a Forest Project's "Primary Effect" (i.e., the Forest 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 Forest Project).[18] 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.

The following tables provide a comprehensive list of the GHG sources, sinks, and reservoirs (SSRs) that may be affected by a Forest Project and indicate which SSRs must be included in the GHG Assessment Boundary for each type of Forest 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.

5.1 Reforestation Projects

Table 5.1.GHG Assessment Boundary – Reforestation Projects

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
Primary Effect Sources, Sinks, and Reservoirs						
RF-1	Standing live carbon (carbon in all portions of living trees)	Reservoir / Pool	CO_2	*Included*	**Baseline:** Modeled based on initial field inventory measurements, regulatory environment, and financial feasibility **Project:** Measured by field measurements and updating forest carbon inventory	Increases in standing live carbon stocks are likely to be the largest Primary Effect of Reforestation Projects. For baseline estimation purposes, pre-existing trees must be distinguished from planted trees. Since pre-existing and new trees are easy to distinguish for several decades after tree planting, pre-existing trees do not need to be inventoried until the Project Operator first seeks verification of GHG reductions and removals (subsequent to the project's initial site visit verification and registration).
RF-2	Shrubs and herbaceous	Reservoir / Pool	CO_2	*Included for site*	**Baseline:** Measured and assumed to be static with	Shrubs and herbaceous understory may constitute a

[18] The terms "Primary Effect" and "Secondary Effect" come from WRI/WBCSD, 2005. *The Greenhouse Gas Protocol for Project Accounting*, World Resources Institute, Washington, DC. Available at http://www.ghgprotocol.org.

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
	understory carbon			*preparation activities*	start date inventory estimates **Project:** Estimated decrease at project initiation with site preparation and assumed static thereafter	significant portion of carbon affected by Reforestation Projects as part of site preparation.
RF-3	Standing dead carbon (carbon in all portions of dead, standing trees)	Reservoir / Pool	CO_2	*Included for project activities*	**Baseline:** N/A **Project:** Measured by updating forest carbon inventory. Does not include pre-existing dead and dying trees at project commencement.	Reforestation Projects are often implemented following disturbance events. Dead trees may continue to fall, become lying dead wood, and contribute to a reversal, even though the primary effect of planting trees continues to increase over time. The protocol requires recruitment and retention of dead material, including standing dead wood as a structural element, so further quantification is not required for standing dead carbon present at project commencement. Minimum volume thresholds are stated to meet Natural Forest Management criteria. (See Section 3.6.2). However, projects must measure planted trees that become standing dead trees, as this is part of the project's primary effect. Projects should define the project year in which standing dead carbon will begin to be measured in the OPDR.
RF-4	Lying dead wood carbon	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Lying dead wood may constitute a significant amount of carbon affected by Reforestation Projects as part of site preparation. However, it is assumed that a comparable quantity of lying dead wood will decompose over the course of the 100-year modeled baseline. Since no significant change is expected between the baseline and project scenarios, lying dead wood will be accounted for through the Natural Forest Management criteria. For Natural Forest Management criteria, the protocol requires recruitment and retention of dead material, including lying dead wood as a structural element. Minimum volume thresholds are stated to meet Natural Forest Management criteria. (See Section 3.6.2).
RF-5	Litter and duff carbon (carbon	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Carbon from litter and duff may be affected by Reforestation Projects as part of site

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
	in dead plant material)					preparation, but the emission source is assumed to be *de minimis.*
RF-6	Soil carbon	Reservoir / Pool	CO_2	*Included*	**Baseline:** Assumed to be static with start date inventory estimates **Project:** Emissions from project activities estimated with standardized guidelines in Appendix B	Soil carbon may constitute a significant portion of carbon affected by reforestation projects. All projects must use standardized guidance to account for potential soil carbon emissions associated with management activities.
RF-7	Carbon in in-use forest products	Source / Sink	CO_2	*Included*	**Baseline:** Estimated from modeled harvesting volumes **Project:** Estimated from measured harvesting volumes	Included because many Reforestation Projects will significantly increase 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, in each year. 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 annual net GHG removals/emissions. This approach accounts for CO_2 emissions from decomposition or disposal of wood products (see SSR RF-17).
RF-8	Forest product carbon in landfills	Reservoir / Pool	CO_2	*Excluded when project harvesting exceeds baseline* *Included when project harvesting is below baseline*	**Baseline:** Estimated from modeled harvesting volumes **Project:** Estimated from measured 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 in years when project harvesting volumes exceed baseline volumes. Landfill carbon is included, however, in years 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 Forest Project are not overestimated.
Secondary Effect Sources, Sinks, and Reservoirs						
RF-9	Biological emissions from site preparation activities	Source	CO_2	*Included*	**Baseline:** N/A **Project:** Quantified based on measured carbon stock changes in included reservoirs as part of site preparation (see above)	Biological emissions from site preparation are not quantified separately, but rather are captured by measuring changes in included carbon reservoirs (shrubs and herbaceous understory; soil carbon where applicable). Reforestation Projects are not eligible if harvesting of live trees (standing live carbon) has occurred within

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						the Project Area within the last 10 years.
RF-10	Mobile combustion emissions from site preparation activities	Source	CO_2	*Included*	**Baseline:** N/A **Project:** Estimated using default emission factors	Mobile combustion CO_2 emissions from Reforestation Project site preparation activities can be significant relative to total GHG reductions/removals and are included in the GHG Assessment Boundary for this version of the Forest Protocol.
			CH_4	*Excluded*	**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	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in N_2O emissions from mobile combustion associated with site preparation activities are not considered significant.
RF-11	Mobile combustion emissions from ongoing project operation and maintenance	Source	CO_2	*Excluded*	**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.
			CH_4	*Excluded*	**Baseline:** N/A **Project:** N/A	CH_4 emissions from mobile combustion associated with ongoing project operation and maintenance activities are not considered significant.
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	N_2O emissions from mobile combustion associated with ongoing project operation and maintenance activities are not considered significant.
RF-12	Stationary combustion	Source	CO_2	*Excluded*	**Baseline:** N/A	Stationary combustion CO_2 emissions from ongoing project

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
	emissions from ongoing project operation and maintenance				**Project:** N/A	operation and maintenance could include GHG emissions associated with electricity consumption or heating/cooling at Project Operator 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.
			CH_4	*Excluded*	**Baseline:** N/A **Project:** N/A	CH_4 emissions from stationary combustion associated with ongoing project operation and maintenance activities are not considered significant.
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	N_2O emissions from stationary combustion associated with ongoing project operation and maintenance activities are not considered significant.
RF-13	Biological emissions from clearing of forestland outside the Project Area	Source	CO_2	*Included*	**Baseline:** N/A **Project:** Estimated using default land-use conversion factors for non-project land	Reforestation Projects on land currently used for grazing or growing crops may cause displacement of these activities to other lands, leading to a reduction in carbon stocks on those lands (e.g., due to clearing of trees and shrubs). The shift may be either a market or physical response to the project activity. Emission associated with shifting land uses are estimated using default "leakage" factors, as detailed in Figure 6.1.
RF-14	Biological emissions/ removals from changes in harvesting on forestland outside the Project Area	Source / Sink	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Reforestation Projects will tend to increase harvesting levels relative to the baseline, potentially causing other landowners to reduce harvesting in response to increased wood product supply. 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. Reforestation Projects are not expected to cause an increase in harvesting on other lands

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						(except where clearing is involved for other land uses, per SSR RF-13), so this potential effect is also excluded from the GHG Assessment Boundary.
RF-15	Combustion emissions from production, transportation, and disposal of forest products	Source	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in activity due to the project will have are presumed to 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	*Excluded*	**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	*Excluded*	**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.
RF-16	Combustion emissions from production, transportation, and disposal of alternative materials to forest products	Source	CO_2	*Excluded*	**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) However, the impact of this increase or decrease in emissions is likely to be minimal and infeasible to quantify. These emissions are therefore excluded from the GHG Assessment Boundary.
			CH_4	*Excluded*	**Baseline:** N/A **Project:** N/A	

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						materials are not considered significant.
			N_2O	*Excluded*	**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.
RF-17	Biological emissions from decomposition of forest products	Source	CO_2	*Included*	**Baseline:** Quantified as a component of calculating carbon stored for 100 years in wood products (SSR RF-7) and landfills (SSR RF-8) **Project:** Quantified as a component of calculating carbon stored for 100 years in wood products (SSR RF-7) and landfills (SSR RF-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 RF-7 and Appendix B).
			CH_4	*Excluded*	**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. These emissions are therefore excluded from the GHG Assessment Boundary.
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	Decomposition of forest is not expected to be a significant source of N_2O emissions.

5.2 Improved Forest Management Projects

Table 5.2. GHG Assessment Boundary – Improved Forest Management Projects

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
Primary Effect Sources, Sinks, and Reservoirs						
IFM-1	Standing live carbon (carbon in all portions of living trees)	Reservoir / Pool	CO_2	*Included*	**Baseline:** Modeled based on initial field inventory measurements, regulatory environment, and financial feasibility, with Common Practice as a governor	Increases in standing live carbon stocks are likely to be the largest Primary Effect of Improved Forest Management Projects.

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
					Project: Measured by field measurements and updating forest carbon inventory	
IFM-2	Shrubs and herbaceous understory carbon	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Shrubs and herbaceous understory constitute a relatively small proportion of carbon stocks in an Improved Forest Management project.
IFM-3	Standing dead carbon (carbon in all portions of dead, standing trees)	Reservoir / Pool	CO_2	*Included*	**Baseline:** Assumed to be static based on initial field inventory measurements **Project:** Measured by updating forest carbon inventory	Improved Forest Management Projects may significantly increase standing dead carbon stocks over time. The protocol requires recruitment and retention of dead material, including standing dead wood as a structural element. Minimum volume thresholds are stated to meet Natural Forest Management criteria. (See Section 3.6.2.)
IFM-4	Lying dead wood carbon	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Lying dead wood is highly variable and it is therefore difficult to achieve accurate estimates. It also constitutes a minor portion of forest carbon. With required retention for Natural Forest Management (see below), it is a conservative programmatic measure not to include it. For Natural Forest Management criteria, the protocol requires recruitment and retention of dead material, including lying dead wood as a structural element. Minimum volume thresholds are stated to meet Natural Forest Management criteria. (See Section 3.6.2.)
IFM-5	Litter and duff carbon (carbon in dead plant material)	Reservoir / Pool	CO_2	*Excluded*	**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.
IFM-6	Soil carbon	Reservoir / Pool	CO_2	*Included for emissions estimates*	**Baseline:** Assumed to be static with start date inventory estimates **Project:** Emissions from project activities estimated with standardized guidelines in Appendix B	Soil carbon is not anticipated to change significantly as a result of most Improved Forest Management activities. However, all projects must use standardized guidance to account for potential soil carbon emissions associated with management activities.
IFM-7	Carbon in in-use forest products	Reservoir / Pool	CO_2	*Included*	**Baseline:** Estimated from modeled harvesting volumes **Project:** Estimated from measured harvesting volumes	Included because many Improved Forest Management 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

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						according to the change in harvesting volumes, relative to baseline levels, in each year. 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 annual net GHG removals/emissions. This approach accounts for CO_2 emissions from decomposition or disposal of wood products (see SSR IFM-17).
IFM-8	Forest product carbon in landfills	Reservoir / Pool	CO_2	*Excluded when project harvesting exceeds baseline* *Included when project harvesting is below baseline*	**Baseline:** Estimated from modeled harvesting volumes **Project:** Estimated from measured 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 in years when project harvesting volumes exceed baseline volumes. Landfill carbon is included, however, in years 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 Forest Project are not overestimated.
Secondary Effect Sources, Sinks, and Reservoirs						
IFM-9	Biological emissions from site preparation activities	Source	CO_2	*Included*	**Baseline:** N/A **Project:** Quantified based on measured carbon stock changes in included reservoirs (SSR IFM-6, where applicable)	Biological emissions from site preparation are not quantified separately, but rather are captured by measuring changes in included carbon reservoirs (soil carbon, where applicable). For other carbon reservoirs, changes are unlikely to have a significant effect on total quantified GHG reductions/removals.
IFM-10	Mobile combustion emissions from site preparation activities	Source	CO_2	*Excluded*	**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 Improved Forest Management Projects.
			CH_4	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in CH_4 emissions from mobile combustion associated with site preparation activities are not considered significant.

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in N_2O emissions from mobile combustion associated with site preparation activities are not considered significant.
IFM-11	Mobile combustion emissions from ongoing project operation and maintenance	Source	CO_2	*Excluded*	**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.
			CH_4	*Excluded*	**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	*Excluded*	**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.
IFM-12	Stationary combustion emissions from ongoing project operation and maintenance	Source	CO_2	*Excluded*	**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 Operator 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.
			CH_4	*Excluded*	**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	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in N_2O emissions from stationary combustion associated with ongoing project operation and

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						maintenance activities are not considered significant.
IFM-13	Biological emissions from clearing of forestland outside the Project Area	Source	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Improved Forest Management Projects are not expected to cause significant shifts in alternative land uses that might lead to clearing of forestland.
IFM-14	Biological emissions/ removals from changes in harvesting on forestland outside the Project Area	Source / Sink	CO_2	*Included / Excluded*	**Baseline:** N/A **Project:** Estimated "leakage" factor applied to the difference in harvested carbon relative to baseline based on the magnitude of that difference relative to baseline harvest amounts	Improved Forest Management 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.
IFM-15	Combustion emissions from production, transportation, and disposal of forest products	Source	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in activity due to the project are presumed to 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	*Excluded*	**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	*Excluded*	**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.
IFM-16	Combustion emissions from production, transportation, and disposal of	Source	CO_2	*Excluded*	**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

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
	alternative materials to forest products					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. These emissions are therefore excluded from the GHG Assessment Boundary.
			CH_4	*Excluded*	**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	*Excluded*	**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.
IFM-17	Biological emissions from decomposition of forest products	Source	CO_2	*Included*	**Baseline:** Quantified as a component of calculating carbon stored for 100 years in wood products (SSR IFM-7) and landfills (SSR IFM-8) **Project:** Quantified as a component of calculating carbon stored for 100 years in wood products (SSR IFM-7) and landfills (SSR IFM-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 IFM-7 and Appendix B).
			CH_4	*Excluded*	**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. These emissions are therefore excluded from the GHG Assessment Boundary.

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	Decomposition of forest is not expected to be a significant source of N_2O emissions.

5.3 Avoided Conversion Projects

Table 5.3. GHG Assessment Boundary – Avoided Conversion Projects

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
Primary Effect Sources, Sinks, and Reservoirs						
AC-1	Standing live carbon (carbon in all portions of living trees)	Reservoir / Pool	CO_2	*Included*	**Baseline:** Modeled based on initial field inventory measurements and expected land-use conversion rates **Project:** Measured by field measurements and updating forest carbon inventory	Preservation and/or increases of standing live carbon stocks relative to baseline levels are likely to be a large Primary Effect of Avoided Conversion Projects.
AC-2	Shrubs and herbaceous understory carbon	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in this reservoir/reservoir are unlikely to have a significant effect on total quantified GHG reductions/removals. Additionally, it is a conservative programmatic measure to exclude shrubs and herbaceous understory carbon.
AC-3	Standing dead carbon (carbon in all portions of dead, standing trees)	Reservoir / Pool	CO_2	*Included*	**Baseline:** Assumed to be static based on initial field inventory measurements **Project:** Measured by updating forest carbon inventory	Avoided Conversion Projects may significantly increase standing dead carbon stocks over time. The protocol requires recruitment and retention of dead material, including standing dead wood as a structural element. Minimum volume thresholds are stated to meet Natural Forest Management criteria. (See Section 3.6.2).
AC-4	Lying dead wood carbon	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Exclusion of lying dead wood is programmatically conservative for accounting of total quantified GHG reductions/removals, since project activities most likely will lead to increases in lying dead wood carbon. Lying dead wood is highly variable and is difficult to measure accurately, and therefore challenging to achieve confidence with estimates. For Natural Forest Management criteria, the protocol requires recruitment and retention of dead material, including lying dead wood as a structural element. Minimum volume thresholds are stated to meet Natural Forest Management criteria. (See Section 3.6.2).

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
AC-5	Litter and duff carbon (carbon in dead plant material)	Reservoir / Pool	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Exclusion of litter and duff carbon is programmatically conservative for accounting of total quantified GHG reductions/removals, since project activities most likely will lead to increases in litter and duff carbon. Litter and duff is highly variable, difficult to measure accurately, and therefore challenging to achieve confidence with estimates.
AC-6	Soil carbon	Reservoir / Pool	CO_2	*Included/Excluded*	**Baseline**: Modeled based on initial field inventory measurements and expected land-use conversion rates **Project:** Measured by updating forest carbon inventory	Included/ Excluded Soil carbon must be included in the Offset Project Boundary, if any of the following activities occur: Site preparation activities involve deep ripping, furrowing, or plowing where soil disturbance exceeds (or is expected to exceed from the baseline characterization and modeling) 25 percent of the project area over the project life, or Mechanical site preparation activities are not conducted on contours. No crediting of increased soil carbon is allowed.
AC-7	Carbon in in-use forest products	Reservoir / Pool	CO_2	*Included*	**Baseline:** Estimated from modeled harvesting volumes **Project:** Estimated from measured harvesting volumes	Included because many Avoided Conversion 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, in each year. 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 annual net GHG removals/emissions. This approach accounts for CO_2 emissions from decomposition or disposal of wood products (see SSR AC-17).
AC-8	Forest product carbon in landfills	Reservoir / Pool	CO_2	*Excluded when project harvesting exceeds baseline* *Included when project harvesting is below baseline*	**Baseline:** Estimated from modeled harvesting volumes **Project:** Estimated from measured 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 in years when project harvesting volumes exceed baseline volumes. Landfill carbon is included, however, in years 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 Forest Project are not overestimated.
Secondary Effect Sources, Sinks, and Reservoirs						
AC-9	Biological emissions from	Source	CO_2	*Included*	**Baseline:** N/A	Biological emissions from site preparation are not quantified separately, but rather are captured by measuring changes in

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
	site preparation activities				**Project:** Quantified based on measured carbon stock changes in included reservoirs (SSR AC-6, where applicable)	included carbon reservoirs (soil carbon, where applicable). For other carbon reservoirs, changes are unlikely to have a significant effect on total quantified GHG reductions/removals.
AC-10	Mobile combustion emissions from site preparation activities	Source	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Mobile combustion CO_2 emissions from site preparation (including land-use conversion activities) are likely to be higher in the baseline than under project. These emissions are therefore excluded from the GHG Assessment Boundary in order to be conservative.
			CH_4	*Excluded*	**Baseline:** N/A **Project:** N/A	Differences in CH_4 emissions from mobile combustion associated with site preparation activities are not considered significant.
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	Differences in N_2O emissions from mobile combustion associated with site preparation activities are not considered significant.
AC-11	Mobile combustion emissions from ongoing project operation and maintenance	Source	CO_2	*Excluded*	**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.
			CH_4	*Excluded*	**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	*Excluded*	**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.
AC-12	Stationary combustion emissions from ongoing project operation and maintenance	Source	CO_2	*Excluded*	**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 Operator facilities, or at facilities owned or controlled by contractors. These emissions are unlikely to be significantly different from (or will be lower than) baseline levels

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						and are therefore not included in the GHG Assessment Boundary. In addition, this protocol 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 Forest Project will have no effect on total net emissions.
			CH_4	*Excluded*	**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	*Excluded*	**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.
AC-13	Biological emissions from clearing of forestland outside the Project Area	Source	CO_2	*Included*	**Baseline:** N/A **Project:** Estimated using default forestland conversion factors	Avoided Conversion Projects may cause land-use pressures to shift to other forestlands, causing biological emissions that partially negate the benefits of the project.
AC-14	Biological emissions/ removals from changes in harvesting on forestland outside the Project Area	Source / Sink	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Over time, Avoided Conversion Projects will tend to increase harvesting levels relative to the baseline, potentially causing other landowners to reduce harvesting in response to increased wood product supply. 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. Avoided Conversion Projects are not expected to cause an increase in harvesting on other lands over the long run (except where clearing is involved for other land uses, per SSR AC-13), so this potential effect is also excluded from the GHG Assessment Boundary.
AC-15	Combustion emissions from production, transportation, and disposal of forest products	Source	CO_2	*Excluded*	**Baseline:** N/A **Project:** N/A	Changes in activity due to the project are presumed to 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	*Excluded*	**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.

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
			N_2O	*Excluded*	**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.
AC-16	Combustion emissions from production, transportation, and disposal of alternative materials to forest products	Source	CO_2	*Excluded*	**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. These emissions are therefore excluded from the GHG Assessment Boundary.
			CH_4	*Excluded*	**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	*Excluded*	**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.
AC-17	Biological emissions from decomposition of forest products	Source	CO_2	*Included*	**Baseline:** Quantified as a component of calculating carbon stored for 100 years in wood products (SSR AC-7) and landfills (SSR AC-8) **Project:** Quantified as a component of calculating carbon stored for 100 years in wood products (SSR AC-7) and landfills (SSR AC-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 AC-7 and Appendix B).
			CH_4	*Excluded*	**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. These emissions are therefore

SSR	Description	Type	Gas	Included or Excluded	Relevant to Baseline or Project	Justification/Explanation
						excluded from the GHG Assessment Boundary.
			N_2O	*Excluded*	**Baseline:** N/A **Project:** N/A	Decomposition of forest products is not expected to be a significant source of N_2O emissions.

6 Quantifying Net GHG Reductions and Removals

This section provides requirements and guidance for quantifying a Forest Project's net GHG reductions and removals. Ecology will issue Ecology Offset Credits to a Forest Project upon confirmation by an Ecology approved verification body that the Forest Project's GHG reductions and removals have been quantified following the applicable requirements of this section (see Section 8 for verification requirements).

For each type of Forest Project, 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 a Forest Project. To establish baseline onsite carbon stocks, the Project Operator must estimate 100 years of carbon stock changes in each of the Forest Project's required and selected optional onsite carbon pools (identified in Section 5). The baseline must be based on inventoried carbon stocks at the time of the Forest Project's initiation (or when first inventoried, as is allowed for Reforestation Projects), following the applicable requirements in this section for modeling or implementing a conservative default baseline. Onsite carbon stocks are inventoried following the requirements described in Appendix B. Modeling of onsite carbon stocks over time must be conducted following the requirements in this section and the guidance in Appendix B. Baseline onsite carbon stocks are estimated over a Forest Project's entire crediting period at the time of the project's initiation and are not modified thereafter, except for reconciliation of project baselines to changes in inventory estimates associated with inventory methodology updates.
2. **Estimating baseline carbon in harvested wood products.** In conjunction with estimating baseline onsite carbon stocks, the Project Operator must forecast any harvesting that would have occurred in the baseline and convert this to an average annual harvesting volume. From this, the Project Operator must determine the amount of carbon that would have been transferred each year (on average) to long-term storage in wood products. Baseline harvesting is forecasted following the guidance in this section, depending on the project type - either through a default or modeling approach, and carbon stored in wood products must be calculated following the requirements in Appendix B.
3. **Determining actual onsite carbon stocks.** Each year, the Project Operator must determine the Forest Project's actual onsite carbon stocks. This must be done by updating the Forest Project's forest carbon inventory for the current year, following the guidance in this section and in Appendix B. The estimate of actual onsite carbon stocks must be adjusted by an appropriate confidence deduction, as described in Appendix B.
4. **Determining actual carbon in harvested wood products.** Each year, the Project Operator must report any harvesting in the Project Area and from this determine the amount of carbon transferred to long-term storage in wood products. Carbon stored in wood products must be calculated following the requirements available in Appendix B
5. **Calculating the project's Primary Effect.** Each year, the Project Operator must quantify the actual change in GHG emissions or removals associated with the Forest Project's intended ("Primary") effect, as defined in Section 5. For any given year, the Primary Effect is calculated by:

a. Taking the difference between actual onsite carbon stocks for the current year and actual onsite carbon stocks for the prior year[19]
b. Subtracting from (a) the difference between baseline onsite carbon stocks for the current year and baseline onsite carbon stocks for the prior year
c. Adding to (b) the calculated difference between actual and baseline carbon in harvested wood products for the current year (see Equation 6.1)

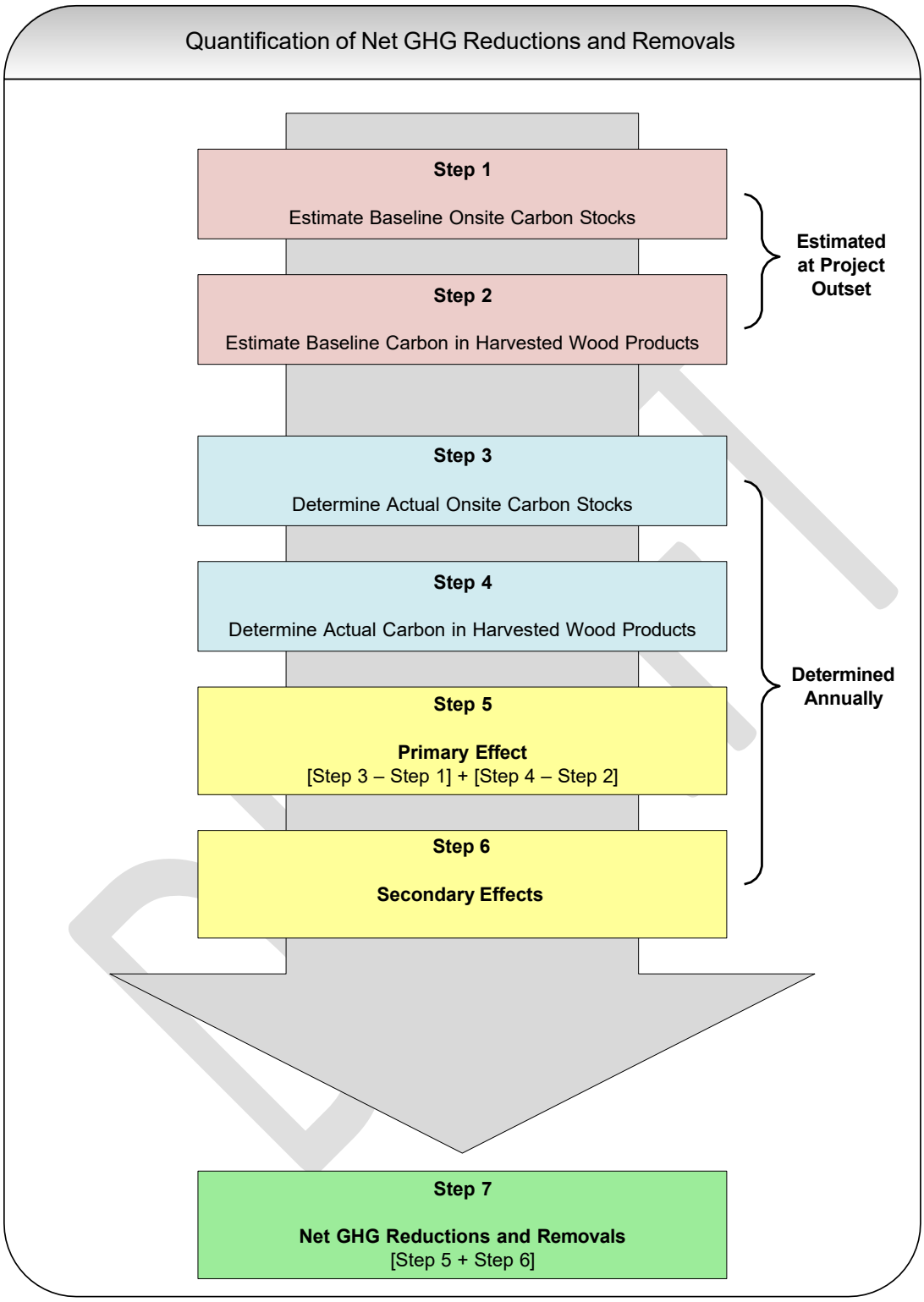
6. **Quantifying the project's Secondary Effects.** Each year, the Project Operator must quantify the actual change in GHG emissions or removals associated with the Forest Project's unintended ("Secondary") effects, as defined in Section 5. Requirements and guidance for quantifying Secondary Effects are provided below for each type of Forest Project.

7. **Calculating total net GHG reductions and removals.** For each year, total net GHG reductions and removals are calculated by summing a Forest Project's Primary and Secondary Effects. If the result is positive, then the Forest Project has generated GHG reductions and/or removals in the current year. If the result is negative, this may indicate a reversal has occurred. Reversals must be compensated in accordance with WAC 173-446-570.

   Requirements and guidance for how to perform quantification steps 1 to 4 for each Forest Project type are presented in the remainder of this section.

   The required formula for quantifying annual 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. The Climate Action Reserve provides a Calculation Worksheet that is to be used by all Forest Projects to facilitate the calculation of offsets based on the equations provided throughout this section. Additionally, the Calculation Worksheet determines the offsets based on GHG reductions and those based on removals. Under this protocol, any quantity of offsets based on a decrease in the baseline carbon stocking relative to inventoried carbon stocking is considered a GHG reduction. This includes the amount by which an Improved Forest Management Project's initial carbon stocking exceeds the baseline carbon stocking, as further described in Section 6.2. Any quantity of offsets based on an increase in reported project carbon stocking is considered a removal, including when actual carbon in harvested wood products relative to baseline carbon in harvested wood products.

[19]For the purposes of calculating the project's Primary Effect, actual and baseline carbon stocks prior to the start date of the project are assumed to be zero.


Quantification of Net GHG Reductions and Removals
Step 1
Estimate Baseline Onsite Carbon Stocks
Step 2
Estimate Baseline Carbon in Harvested Wood Products
Estimated at Project Outset
Step 3
Determine Actual Onsite Carbon Stocks
Step 4
Determine Actual Carbon in Harvested Wood Products
Step 5
Primary Effect
[Step 3 – Step 1] + [Step 4 – Step 2]
Step 6
Secondary Effects
Determined Annually
Step 7
Net GHG Reductions and Removals
[Step 5 + Step 6]

Equation 6.1. Annual Net GHG Reductions and Removals

$$\boldsymbol{QR_y = \left[(\Delta AC_{onsite} - \Delta BC_{onsite}) + SC_y + \left(AC_{wp,y} - BC_{wp,y}\right) \times 0.80 + SE_{as,y}\right] + N_{y-1}}$$

Where,			Units
QR_y	=	Quantified GHG reductions and removals for year *y*	tCO_2e
SC_y	=	Soil carbon project emissions (if included, and if using the standardized guidance in Appendix B).	tCO_2e
$AC_{wp,\,y}$	=	Actual carbon in wood products produced in year *y* that is projected to remain stored for at least 100 years (i.e., derived for actual harvest volumes following the guidance in Appendix B)	tCO_2e
$BC_{wp,y}$	=	Annual baseline carbon in wood products that would have remained stored for at least 100 years (i.e., derived for baseline harvest volumes following the guidance in Appendix B)	tCO_2e
0.80	=	The 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 a Forest Project, the market will compensate with an increase in harvesting of 0.2 tonnes on other lands (see Section 5.2.6). 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.[22] 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.	
$SE_{as,y}$	=	Secondary Effect GHG emissions that may result from activity shifting outside the project area, as a result of the project activity in year *y*	tCO_2e
N_{y-1}	=	Any negative carryover from the prior year (occurs when total quantified GHG reductions are negative prior to the issuance of any offsets for the project– see footnote 21, p. 52)	tCO_2e

And,

$$\boldsymbol{\Delta AC_{onsite} = \left(AC_{onsite,y}\right)\left(1 - CD_y\right) - \left(AC_{onsite,y-1}\right)\left(1 - CD_{y-1}\right)}$$

Where,

$AC_{onsite,\,y}$	=	Actual onsite carbon as inventoried for year *y* (*y* may be less than a year for the first reporting period following the start date).	tCO_2e

[22] For conservativeness and ease of accounting, these wood-product market "leakage" effects are ignored for Reforestation Projects and Avoided Conversion Projects, since overall these projects will tend to result in increased harvesting relative to the baseline. Market leakage effects are accounted for under Improved Forest Management Projects, however, as described in Section 5.2.6.

$AC_{onsite,\ y\text{-}1}$	=	Actual onsite carbon as inventoried for year *y-1*.	tCO_2e
CD_y	=	Appropriate confidence deduction for year *y*, as determined following the Appendix B	%
$CD_{y\text{-}1}$	=	Appropriate confidence deduction for year *y-1*, as determined following the Appendix B	%

And,

$$\Delta \boldsymbol{BC_{onsite}} = \left(\boldsymbol{BC_{onsite,y}}\right) - \left(\boldsymbol{BC_{onsite,y-1}}\right)$$

Where,

$BC_{onsite,\ y}$	=	Baseline onsite carbon as estimated for year *y* (*y* may be less than a year for the first reporting period following the start date)	tCO_2e
$BC_{onsite,\ y\text{-}1}$	=	Baseline onsite carbon as estimated for year *y-1*	tCO_2e

6.1 Reforestation Projects

6.1.1 Estimating Baseline Onsite Carbon Stocks

To estimate baseline carbon stocks for a Reforestation Project, the Project Operator must:

1. Provide a qualitative characterization of the likely vegetative conditions and activities that would have occurred without the project, taking into consideration any laws, statutes, regulations, or other legal mandates that would encourage or require reforestation on the Project Area. The qualitative assessment must be used as the basis for modeling baseline carbon stocks (step 3).
2. Inventory carbon stocks affected by site preparation prior to any site preparation activities, following the guidance in Appendix B for sampling carbon pools affected by site preparation for Reforestation Projects.

   For carbon stocks not affected by site preparation, the inventory may be deferred, as described below.
3. Perform a computer simulation, once an inventory is obtained, that models the carbon stocks (from required and any selected optional pools) for 100 years following the project's start date, based on the qualitative characterization of what would have occurred without the project. The Project Operator must follow the requirements and guidance for modeling contained in Appendix B, incorporating any conditions and constraints specified in the qualitative characterization of the baseline (step 1, above). The computer simulation must model the expected growth in carbon stocks associated with pre-existing trees in the Project Area (i.e., those not planted as part of the Forest Project).

Deferral of Initial Inventory for Carbon Stocks Not Affected by Site Preparation

The inventory of carbon stocks that are not affected by site preparation may be deferred until a Reforestation Project's second site visit verification. By the second site visit verification, the Project Operator must provide an estimated inventory of all required carbon stocks by using an

approved growth model or a stand table projection methodology, as described in Appendix B, to determine the *average* amount of carbon in standing live carbon stocks (prior to delivery to a mill) that would have been harvested in each year of the baseline over 100 years. The result will be a uniform estimate of harvested carbon in each year of the baseline. This estimate is determined at the project outset, using the same biomass equations used to calculate biomass in live trees, and will not change over the course of the project.

1. On an annual basis, determine the amount of harvested carbon that would have remained stored in wood products, averaged over 100 years, following the requirements in Appendix B.

6.1.2 Determining Actual Onsite Carbon Stocks

Actual carbon stocks for Reforestation Projects must be determined by updating the Project Area's forest carbon inventory. This is done by:

1. Incorporating any new forest inventory data obtained during the previous year into the inventory estimate. Any plots sampled during the previous year must be incorporated into the inventory estimate.
2. Using an approved model to "grow" (project forward) prior-year data from existing forest inventory plots to the current reporting year. Approved growth models are identified in Appendix B. Guidance for projecting forest inventory plot data using models is also provided in Appendix B.
3. Updating the forest inventory estimate for harvests and/or disturbances that have occurred during the previous year.
4. Applying an appropriate confidence deduction for the inventory based on its statistical uncertainty, following the guidance in Appendix B.

6.1.3 Determining Actual Carbon in Harvested Wood Products

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

1. Determine the actual amount of carbon in standing live and dead carbon stocks (prior to delivery to a mill) harvested in the current year (based on harvest volumes determined in Section 6.1.2).
2. Determine the amount of actual harvested carbon that will remain stored in wood products, averaged over 100 years, following the requirements in Appendix B.

6.1.4 Quantifying Secondary Effects

For Reforestation Projects, significant Secondary Effects can arise from two sources:

1. Combustion emissions associated with machinery use in site preparation.
2. The shifting of cropland or grazing activities to forestland outside the Project Area (which may be both a market and/or physical response to the project activity), which is accounted for over the life of the project.

To quantify combustion emissions associated with site preparation, Project Operators must use the appropriate standard emission factor from Table 6.2 corresponding to the level of brush cover associated with the site preparation area, multiplied by the number of acres treated (Equation 6.2).

Mobile combustion emissions must be added to Secondary Effect emissions (SE_y in Equation 6.1) in the first reporting period of a project. If this results in a negative amount for total net quantified GHG reductions and removals in year one (QR_1), the negative amount must be carried over into future years (N_{y-1} in Equation 6.1) until sufficient GHG reductions and removals are accrued to achieve a positive balance. Negative GHG reductions and removals due to site preparation emissions are *not* considered a reversal (Section 7).

Equation 6.2. Combustion Emissions Associated with Site Preparation

$$\boldsymbol{MC_y = (-1) \times (EF_{mc} \times PA)}$$

Where,			Units
MC_y	=	Secondary Effect emissions due to mobile combustion from site preparation	CO_2e
EF_{mc}	=	Mobile combustion emission factor from Table 6.1.	CO_2e
PA	=	Size of the site preparation area	acres

Table 6.1. Mobile Combustion Emissions for Reforestation Projects

Site Prep - Reforestation Projects		
Emissions Associated with Mobile Combustion Average Metric Tons CO_2 per Acre		
Light	**Medium**	**Heavy**
25% Brush Cover	50% Dense Brush Cover	> 50% Brush Cover, stump removal
0.090	**0.202**	**0.429**

To quantify emissions from the shifting of cropland and grazing activities each year, Project Operators must determine the appropriate "leakage" risk percentage for the project following the decision tree in Figure 6.1. The leakage risk percentage must only be determined once, at the outset of the project. Each year, this percentage must be applied to the net increase in onsite carbon stocks to determine the annual Secondary Effects due to shifting of cropland or grazing activities (Equation 6.3).

Equation 6.3. Emissions from Shifting Cropland and Grazing Activities

$$\boldsymbol{AS_y = (-1) \times L \times (\Delta AC_{onsite} - \Delta BC_{onsite})}$$

Where,			Units
AS_y	=	Secondary Effect emissions due to shifting of cropland or grazing activities	CO_2e
L	=	Leakage risk percentage, as determined from Figure 6.1	%
Δ AC_{onsite}	=	Annual difference in actual onsite carbon as defined in Equation 6.1	CO_2e
Δ BC_{onsite}	=	Annual difference in baseline onsite carbon as defined in Equation 6.1	CO_2e

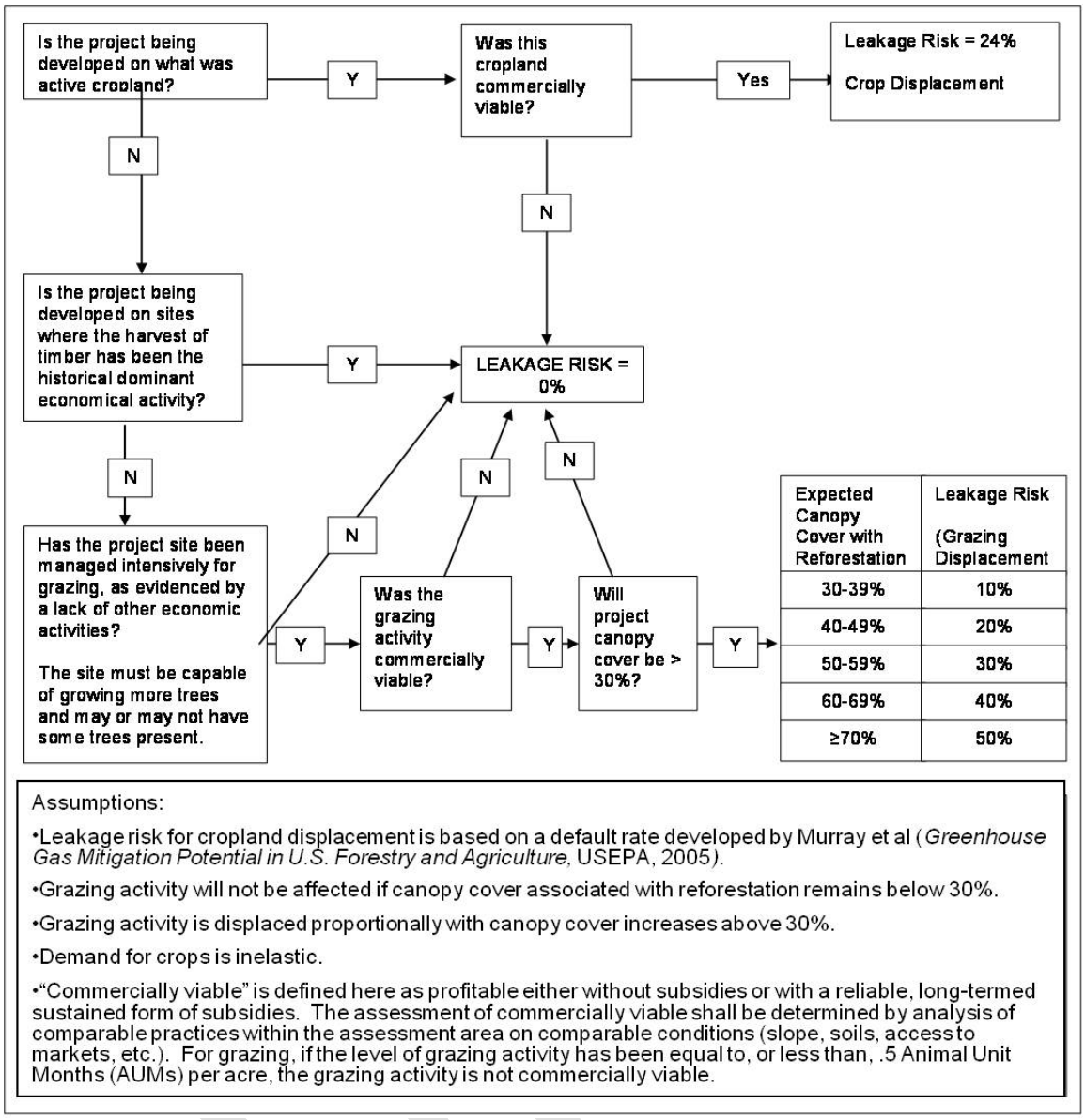


Figure 6.1. Activity Shifting ("Leakage") Risk Assessment for Reforestation Projects

Total Secondary Effect emissions for Reforestation Projects are calculated as follows (Equation 6.4). The value for Secondary Effect emissions will always be negative or zero.

Equation 6.4. Total Secondary Effect Emissions

$$SE_y = (AS_y + MC_y) \text{ or } 0, \text{ whichever is lower}$$

Where,			Units
SE_y	=	Secondary Effect GHG emissions caused by the project activity in year *y* (Equation 6.1)	CO_2e
AS_y	=	Secondary Effect emissions due to shifting of cropland or grazing activities	CO_2e

MC_y	=	Secondary Effect emissions due to mobile combustion from site preparation	CO_2e

6.2 Improved Forest Management Projects

Improved Forest Management Projects that take place on private land – or on land that is transferred to public ownership at the time the project is initiated – must estimate baseline onsite carbon stocks following the requirements and procedures in Section 6.2.1.Improved Forest Management Projects that take place on land that was publicly owned prior to the project start date must estimate baseline onsite carbon stocks following the requirements and procedures in Section 6.2.3. Requirements for determining actual onsite carbon stocks, determining actual carbon in harvested wood products, and quantifying Secondary Effects are the same for all Improved Forest Management Projects.

The approach to additionality for all Improved Forest Management Projects relies on an averaged baseline value. The time commitment for a project under this protocol 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 overall intent of this protocol is to reward forest management that conserves existing carbon stocks and/or increases carbon stocking, as appropriate to retain healthy forest conditions, as the result of financial inputs from carbon markets. Standing Carbon Stocks that are above the project's baseline are deemed additional to stocks that would have occurred in the absence of the forest carbon project. Only additional Standing Carbon Stocks can yield credits that can be transacted in carbon markets. Therefore, the baseline estimate for the project is a critical element of the forest carbon project.

The baseline for Improved Forest Management (IFM) projects is a counterfactual estimate of carbon stocks within the project boundaries in the absence of carbon finance. The baseline estimate is developed through a standardized set of analyses that assess the carbon stocks associated with the likelihood of harvest under business-as-usual conditions. The baseline is a critical component of the IFM project as all carbon stocks that are above the project baseline are considered to be additional. These analyses include:

- A comparison of the project's Standing Carbon Stocks to Standing Carbon Stocks on similar landscapes within the project's assessment area, referred to as Common Practice.
- An analysis of the effects of legal encumbrances on forest management.
- An analysis of the economic opportunities of timber harvest on the project's forests.

Baselines represent business-as-usual management in the absence of carbon finance. Projects with carbon stocks above Common Practice are considered to be at risk of emissions, provided that legal encumbrances and economic indicate favorable conditions for timber harvest. In such cases, the baseline is determined as a declining line from the current project carbon stocks to the Common Practice value over a defined period of 10 years which reflect the avoided emissions as the result of the project activity. This timeframe is aligned with the length of the crediting period.

Where analysis indicates that legal and economic opportunities limit the risk of timber harvest, the estimated baseline must reflect this finding, even if the baseline of carbon stocks is determined to be an increasing trend of Standing Forest Carbon Stocks. As with baselines that indicate risks of emissions, baselines that only include additional Standing Carbon Stocks associated with carbon enhancements are valid for a crediting period of 10

years, which can be renewed for an additional 10-year crediting period if additional crediting is desired.

If ongoing crediting is desired, the analysis of legal and economic constraints must be repeated to develop an updated baseline that reflects the changing dynamics of risks to, and economic opportunities for, timber management within the project area. Credits can only be considered for avoided emissions associated with declining carbon stocks during the first 10-year crediting period. Therefore, Common Practice has no bearing on the baseline at the start of a new crediting period.

The project's baseline is determined through the development of a forest carbon inventory and an analysis of the inventory relative to various tests for additionality and a subsequent analysis to add the carbon stocks in harvested wood products to the forest carbon inventory.

The baseline analysis effort must demonstrate that the counterfactual baseline exceeds legal encumbrances, is economically viable, is not the result of a recent, rapid depletion of timber inventories, is within statistical error bounds of the Common Practice value and, when averaged over the 100-year period, does not go below the Common Practice value determined for the project.

This section outlines the steps involved in developing the project's baseline. The general steps are outlined briefly below and followed with detailed guidance.

6.2.1 Estimating Baseline Onsite Carbon Stocks – Private Lands

The overall intent of this protocol is to reward forest management that conserves existing carbon stocks and/or increases carbon stocking, as appropriate to retain healthy forest conditions, as the result of financial inputs from carbon markets. Standing Carbon Stocks that are above the project's baseline are deemed additional to stocks that would have occurred in the absence of the forest carbon project. Only additional Standing Carbon Stocks can yield credits that can be transacted in carbon markets. Therefore, the baseline estimate for the project is a critical element of the forest carbon project.

The baseline for Improved Forest Management (IFM) projects is a counterfactual estimate of carbon stocks within the project boundaries in the absence of carbon finance. The baseline estimate is developed through a standardized set of analyses that assess the carbon stocks associated with the likelihood of harvest under business-as-usual conditions. The baseline is a critical component of the IFM project as all carbon stocks that are above the project baseline are considered to be additional. These analyses include:

- a comparison of the project's Standing Carbon Stocks to Standing Carbon Stocks on similar landscapes within the project's assessment area, referred to as Common Practice.
- an analysis of the effects of legal encumbrances on forest management.
- an analysis of the economic opportunities of timber harvest on the project's forests.

Baselines represent business-as-usual management in the absence of carbon finance. Projects with carbon stocks above Common Practice are considered to be at risk of emissions, provided that legal encumbrances and economic indicate favorable conditions for timber harvest. In such cases, the baseline is determined as a declining line from the current project carbon stocks to the Common Practice value over a defined period of 10

years which reflect the avoided emissions as the result of the project activity. This timeframe is aligned with the length of the crediting period.

Where analysis indicates that legal and economic opportunities limit the risk of timber harvest, the estimated baseline must reflect this finding, even if the baseline of carbon stocks is determined to be an increasing trend of Standing Forest Carbon Stocks. As with baselines that indicate risks of emissions, baselines that only include additional Standing Carbon Stocks associated with carbon enhancements are valid for a crediting period of 10 years, which can be renewed for an additional 10-year crediting period if additional crediting is desired.

If ongoing crediting is desired, the analysis of legal and economic constraints must be repeated to develop an updated baseline that reflects the changing dynamics of risks to, and economic opportunities for, timber management within the project area. Credits can only be considered for avoided emissions associated with declining carbon stocks during the first 10-year crediting period. Therefore, Common Practice has no bearing on the baseline at the start of a new crediting period.

The project's baseline is determined through the development of a forest carbon inventory and an analysis of the inventory relative to various tests for additionality and a subsequent analysis to add the carbon stocks in harvested wood products to the forest carbon inventory.

The baseline analysis effort must demonstrate that the counterfactual baseline exceeds legal encumbrances, is economically viable, is not the result of a recent, rapid depletion of timber inventories, is within statistical error bounds of the Common Practice value and, when averaged over the 100-year period, does not go below the Common Practice value determined for the project.

This section outlines the steps involved in developing the project's baseline.

6.2.1.1 Determine the start date inventories of the Standing Carbon Stocks[1] for the Project Area

The inventory is the result of a project-based sampling effort aligned with the inventory guidance in Appendix B. The first step in developing a project baseline is to determine an inventory of Standing Carbon Stocks that represent the Start Date condition. The guidelines for developing a forest inventory are described in Appendix B.

6.2.1.2 Determining Common Practice and the Initial Baseline

The determination of the relationship between the Initial Starting Inventory of Standing Carbon Stocks and Common Practice will provide a preliminary indication whether the project may receive credits for avoided emissions. A provisional baseline assumption is developed as a sloped line from the Start Date Standing Carbon Stocks to Common Practice at year 10 for projects with Standing Carbon Stocks above Common Practice. If the Initial Standing Carbon Stocks are at or below Common Practice, the provisional baseline is assumed to be the Initial Onsite Forest Carbon Stocks. Additional tests for legal compliance, financial feasibility, and the High Stocking Reference may alter the provisional baseline.

Common Practice values are based on the Standing Carbon Stocks calculated by the

[1] Standing Carbon Stocks includes above and belowground portions of standing live and dead trees

Program for each Forest Type and each Ecoregion, which comprise the Assessment Area(s) for the project. Common Practice values are calculated using data from the United States Forest Service Forest Inventory and Analysis (USFS FIA) program. These values are provided by the Program on Ecology's website and are updated periodically by the program, outside of rulemaking. Each batch of Common Practice values are referenced with a date range that must align with the project's Start Date for the values to be valid.

The determination of the project's Common Practice value is based on a weighted average of the Forest Type Common Practice values mapped within the project area. The resolution for mapping the forest types is 25 acres, which means that any portion of the forest project area that is contiguous and meets or exceeds 25 acres shall be identified as a polygon on the map.

6.2.1.3 Determine if the Initial Standing Carbon Stocks are within Allowable Limits of Common Practice

A test is conducted to ensure that, if the project's Initial Carbon Stocks exceed the Common Practice value, the difference is within a probable range of the Common Practice value. If not, an adjustment will be applied to the baseline.

The Program will accept that the project baseline can potentially be at the Common Practice value if it meets all the additionality tests and the Initial Standing Carbon Stocks are within the 90% confidence interval calculated from the plot data used to determine Common Practice. If the Standing Carbon Stocks exceed the Common Practice mean value plus the associated 90% error value (provided by the Program at the 90% confidence level), the project baseline value cannot be reduced below the Initial Standing Carbon Stocks minus the 90% error value.

Figure 6.2 displays the concept that the minimum level of the baseline can be no greater than the calculated error value (90%) for the Common Practice value below the Initial Standing Carbon Stocks.

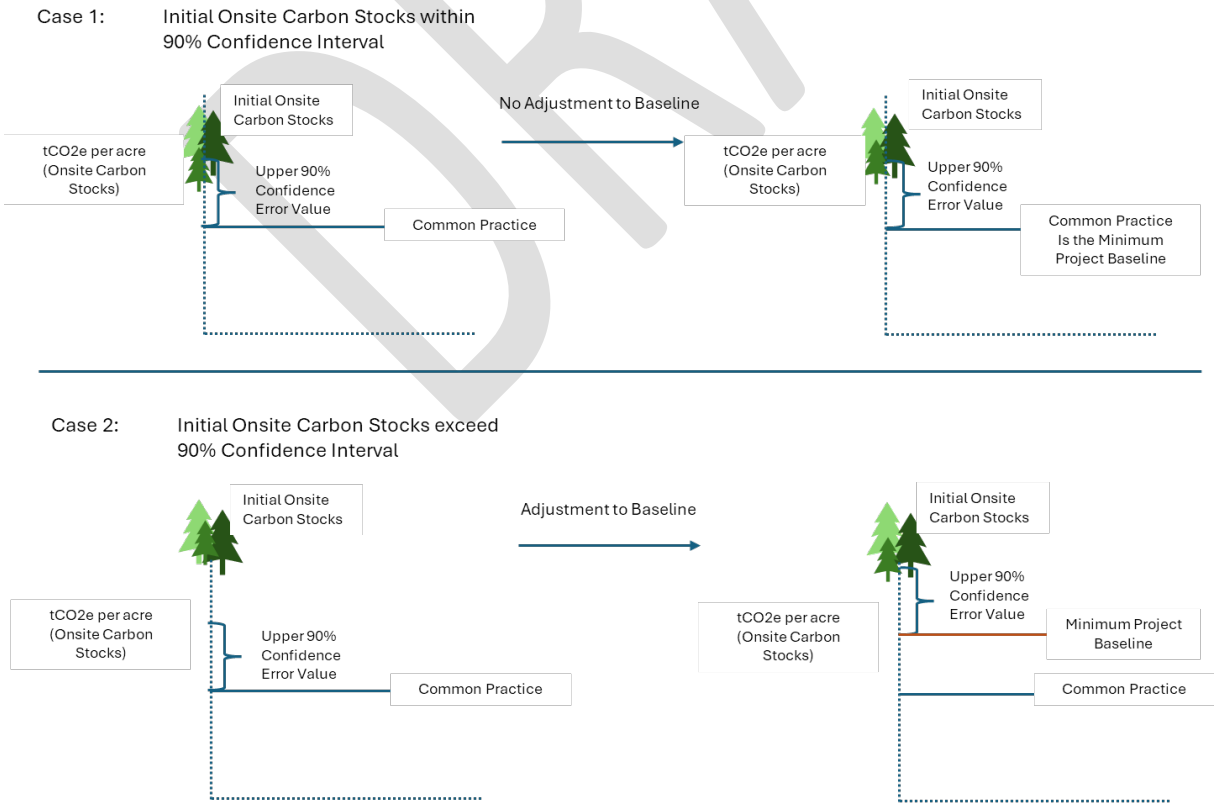


Figure 6.2. Confidence interval parameters for private IFM baseline projects

6.2.1.4 Analyze the effects of legal constraints on timber harvest within the project area.

This test determines the extent to which Standing Carbon Stocks can legally be reduced by timber harvest which may result in an adjustment to the provisional baseline from 6.2.1.2. The project's baseline must address all legal constraints to timber harvest. No claims of additionality can be made for carbon enhancements or avoided emissions that would have happened in the absence of the project due to legal requirements.

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, Habitat Conservation Plans, Safe Harbor Agreements, and other deed restrictions, excepting any encumbrance that was put in place and/or recorded less than one year prior to the project Start Date.

The analysis of the effect of legal constraints on Standing Carbon Stocks is conducted using the Program's Legal Constraint form. The form must be completed by the Professional Forester working with the project. The form must be attached to the project's submission documents and be revised and resubmitted at the initiation of any additional crediting periods that the project chooses to engage in.

The form:

(1) Identifies each legal constraint that limits harvest volume with silviculture treatments. This includes any code or document references.

(2) Describes the intent of the legal constraint.

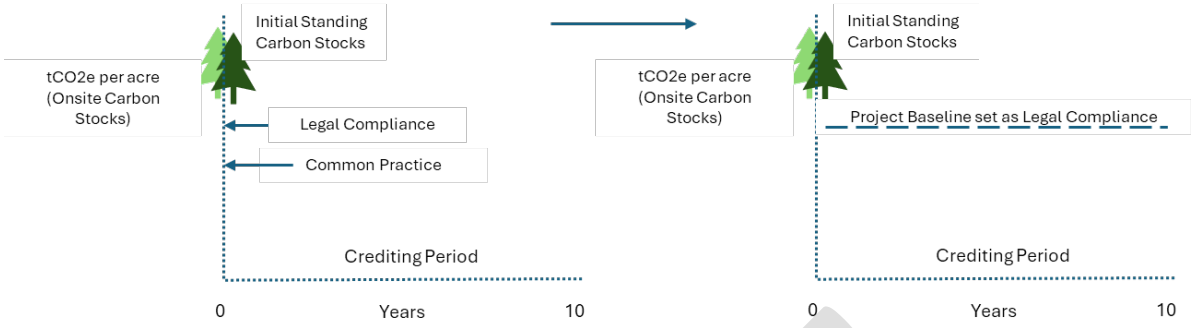
(3) Describes the extent of the legal constraint.

(4) Outlines and describes how the legal constraint will be mitigated using silviculture adjustments.

(5) Provides an estimate of the affect of the proposed mitigation on the projection of Standing Carbon Stocks.

Figure 6.3. displays how the legal constraints test is used to determine the project's crediting period baseline.

Example of Legal Compliance test Determination of Project Baseline



Assume other tests (financial, High Stocking Reference, and allowable delta between Initial Standing Carbon Stocks and Common Practice) are met

Figure 6.3. Legal constraints test for Private IFM project baseline establishment

6.2.1.5 Analyze the financial viability of timber harvest within the project area.

This test confirms that the result of the baseline assumption from 6.2.1.3 is supported by evidence that the assumption is based on cost effective harvesting.

The project's baseline must be based on a harvest scenario that is financially viable. A project cannot receive avoided emission credits that are based on the risk of reducing forest timber inventories if it is not financially viable to do so. Furthermore, a project cannot receive enhancement credits if it is not financially feasible to harvest timber within the Project Area, which would imply that forest growth would have happened in the absence of the project.

A financially viable timber harvest implies that the revenue generated from selling the timber outweighs the expenses involved. Expenses involved in forest management associated with timber harvest include, but are not limited to road construction and maintenance, reforestation, logging and hauling, forest management, and timber yield taxes. Revenues associated with timber harvest are based on delivered log prices.

The Professional Forester must demonstrate financially feasible management using the Program's Demonstration of Financial Feasibility form. The form provides a standardized assessment of financial feasibility based on various cost and revenue inputs. A project that does not demonstrate a financially viable timber harvest is not eligible to submit a project.

6.2.1.6 Calculating the High Stocking Reference

This test ensures that project crediting does not occur for carbon enhancements that would have occurred in the absence of the forest carbon project. The provisional baseline may be adjusted as the result of this analysis.

Credits cannot be issued for Onsite Carbon Stock enhancements that would likely be assured following a high rate of timber exploitation in which the inventory of Standing Carbon Stocks was reduced since it would be highly likely that the stocks would increase in the absence of a carbon market. The High Stocking Reference is a measure of carbon stocks in aboveground standing live and standing dead biomass over the 10 years preceding the project start date.

The High Stocking Reference is defined as 80 percent of the highest value for the Standing

Carbon Stocks per acre within the Project Area during the 10-year period preceding the project start date, or as long as the current Project Operator has had control of the stocks, whichever is shorter. Figure 6.4. presents a graphical portrayal of a High Stocking Reference determination.

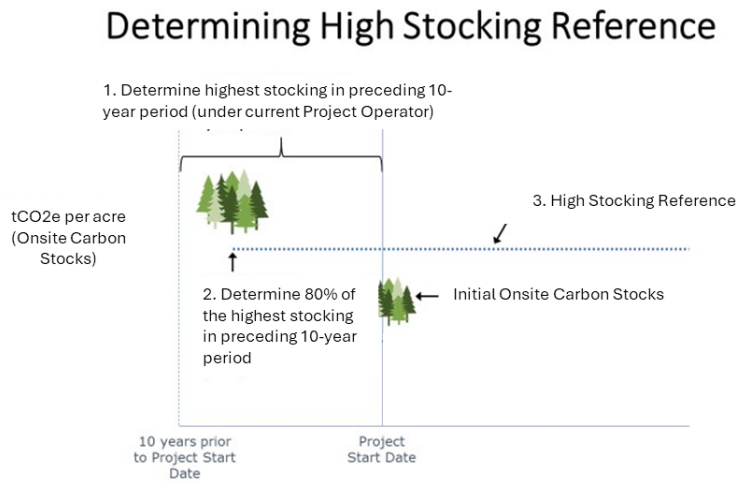


Figure 6.4. Determining a Project Area's High Stocking Reference

6.2.1.7 Summary of the Analytical Approach to Developing the Project Baseline of Standing Carbon Stocks

The project's baseline is developed by applying the project's inventory of Initial Standing Carbon Stocks to the following tests:

(1) The Initial Standing Carbon Stocks are equal to, or exceed, the Common Practice value determined for the project. This applies to the first crediting period only.

(2) The delta between the Common Practice value and the Initial Starting Carbon Stocks does not exceed the 90% sampling error value determined from the plots that were used to estimate Common Practice. This applies to the first crediting period only.

(3) The effect of legal constraints in terms of a feasible inventory projection.

(4) The effect of costs and benefits related to timber management on the inventory projection.

(5) The average Standing Carbon Stocks are equal to, or exceed, the High Stocking Reference.

6.2.1.8 Finalizing the Project Baseline of Standing Carbon Stocks

The analytical approach develops a baseline value of Standing Carbon Stocks. The project's baseline recognizes risks of declining inventory if the determined baseline value is below the Initial Standing Carbon Stocks. In such cases, credits are issued as avoided emissions that would be associated with an inventory reduction of Standing Carbon Stocks through timber harvest. In such a case, the project must account for the avoided emissions over a crediting period of 10-years with a straight-line depletion from the Initial Standing Carbon Stocks to the determined baseline value. Figure 6.5 provides a graphical portrayal of this scenario. The baseline remains constant for the crediting period.

Example of Declining Baseline over Crediting Period

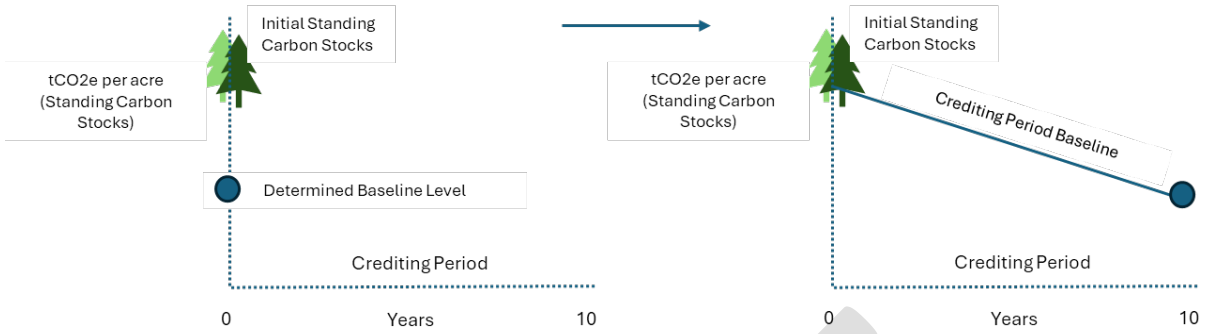


Figure 6.5. Example for a project that demonstrates a harvest scenario that is below the inventory of the initial Standing Carbon Stocks (prior to adjusting the initial 10-year period).

Note that the most conservative constraint, whether it is financial viability (which establishes project eligibility), legal constraints, Common Practice, or the High Stocking Reference establishes the baseline.

Figure 6.6 displays the consequence of the determined baseline level being above the Initial Standing Carbon Stocks.

Example of Baseline above Initial Standing Carbon Stocks

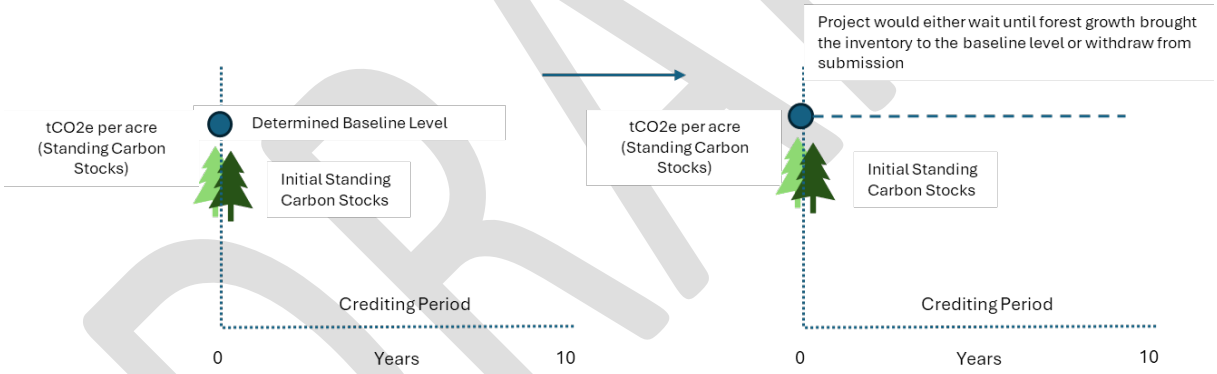


Figure 6.6. Example for a project that demonstrates a baseline determination that is above the inventory of the initial Standing Carbon Stocks. Such a project would likely delay project submission until the Initial Standing Carbon Stocks were equal to, or exceeded, the determined baseline.

6.2.1.9 Determine the carbon in harvested wood products associated with the baseline assumption from Step 5.

The Project Operator must calculate the amount of carbon in harvested wood products associated with harvesting growth at the baseline level determined for the Standing Carbon Stocks. This is accomplished using the guidance in Appendix B. The periodic long-term storage in wood products is calculated as an average, as was done with the Standing Carbon Stocks. It is then added to the calculated baseline of Standing Carbon Stocks to develop the project's crediting period baseline.

Code	Name	Brief Description	States
242A	Puget Trough Lowlands	Marine-influenced glacial lowlands with mixed conifer-hardwood forests and urban-agricultural zones.	WA

Code	Name	Brief Description	States
242B	Willamette Valley Section	Broad alluvial plains with oak-conifer forests and intensive agriculture along the Willamette River.	OR
263A	Northern California Coast Subsection	Redwood and Douglas-fir forests with heavy fog influence; part of the coastal redwood belt.	CA
331A	Northern Basin & Range Section	Arid valleys and low mountain ranges; sagebrush-steppe and Snake River tributaries.	OR, ID
342B	Northwestern Basin & Range Section	Volcanic plateaus and dry valleys with sagebrush and grassland; part of Snake–Columbia watershed.	OR, ID
342C	Owyhee Uplands Section	Upland basalt tablelands and dissected canyons with desert scrub; flows to the Owyhee–Snake system.	OR, ID
342D	Snake River Basalts & Basins Section	Plains, benches, and terraces of the Snake River in Idaho; a mix of agriculture and shrublands.	ID
342H	High Lava Plains Section	Dry volcanic plains and uplands in central Oregon with bunchgrass and juniper woodlands.	OR
342I	Columbia Basin Section	Broad interior basin with arid shrublands; part of the inland Columbia Plateau system.	OR
342L	High Lava Plains (Intermountain Semi-Desert)	Uplifted basalt plateaus with sparse vegetation, cold desert climate, and intermittent streams.	OR, ID
M261A	Klamath Mountains – Coastal Subsection	Rugged, forested coastal ranges with high conifer diversity and maritime climatic influence.	OR
M261D	John Day–Clarno Highlands	Eroded volcanic highlands; dry forests and grasslands feeding the John Day River (Columbia basin).	OR
M261G	Deschutes–Potter Basin	Interior basin of central Oregon with forest-steppe, juniper, and high desert transitioning to plains.	OR
M332G	N. Rocky Mountains Foothill Section	Mixed conifer foothills and valley systems feeding the Clearwater and Snake Rivers.	WA, ID
M333A	Okanogan Highlands Section	Rugged forested highlands and glaciated uplands; headwaters flow to the Columbia via Okanogan/Methow.	WA, ID

Code	Ecosection Name	Dominant FIA Forest-Type Group(s)	Relative Dominance
242A	Puget Trough / Willamette Valley	Western Hemlock–Douglas-fir	~40 %
		Sitka Spruce–Hemlock	~25 %
		Red Alder (hardwood component)	~15 %
242B	Willamette Valley	Douglas-fir	~35 %
		Western Hemlock	~20 %
		Red Alder	~20 %
263A	Northern California Coast (M261 analog)	Douglas-fir	~45 %
		Pacific Silver Fir	~20 %
331A	Northern Basin & Range	Ponderosa Pine	~50 %
		Douglas-fir (riparian)	~15 %
342B	High Lava Plains – subzone B	Ponderosa Pine	~45 %
342C	High Lava Plains – subzone C	Ponderosa Pine	~50 %
342D	High Lava Plains – subzone D	Western Juniper	~30 %
342H	High Lava Plains – subzone H	Ponderosa Pine	~40 %
342I	High Lava Plains – subzone I	Juniper–Pine mix	~35 %
342L	High Lava Plains – subzone L	Ponderosa Pine	~45 %
M261A	Klamath Mountains	Douglas-fir	~40 %
		Tanoak / Hardwood	~20 %
M261D	Southern Cascades	Douglas-fir	~35 %
		True Fir Complex (Pacific silver, grand fir)	~25 %
M261G	Modoc Plateau	Ponderosa Pine	~50 %
M332G	Northern Rocky Mt Foothills	Ponderosa Pine	~40 %
		Douglas-fir Mixed	~20 %
M333A	Okanogan Highlands	Ponderosa Pine	~35 %
		Western Larch / Douglas-fir	~25 %

6.2.2 Estimating Baseline Onsite Carbon Stocks – Public Lands

The baseline is developed for a public forest by determining carbon levels in the Project Area with the assumed condition that the entire forest is at a rotation age common for the forest community (by Assessment Area). The rotation ages are provided as default values and are found with the Assessment Area data. Where forest practice laws, or any other legal encumbrances, require specific management of forest stands at levels that exceed the age criteria mentioned above, the stands must be managed at sufficient stocking levels to ensure compliance with the legal constraints. Project credits are determined by calculating the project's carbon stocks and subtracting the baseline stocks from them.

6.2.2.1 Generate COLE Report

Using the Carbon Online Estimator (COLE),[27] select Forest Inventory and Analysis (FIA) plots using the "plots within this radius" tool. The circle developed must be centered within the Project Area. The radius of the sample area must be at least 100 kilometers. Following the guidance on the website, fetch the data within the circle. Next, filter the data using the 'Filter' tab on the website by selecting species in the 'Forest Type' menu bar that are found in the species list in the Assessment Area Data File for Assessment Area(s) the project is in. Click on the 'Reports' tab and submit the request to produce the 1605(b) report, which will be provided through a web interface. The report must be included as an appendix in the Offset Project Data Report. Using Table 1 of the COLE 1605(b) report, the baseline for the

project, barring any adjustments as part of the legal analysis (below), shall be determined by summing the live tree and dead tree values from the COLE 1605(b) report that correspond with the rotation length value found in Table 6.3. The 1605(b) values are given as metric tons of carbon per hectare and shall be converted into metric tons CO_2e per acre. The determination of rotation length is made using the Assessment Area Data File and identified for rotation length.

Table 6.2. Table Rotation Lengths

Rotation Length	Years
Short	30
Medium	40
Long	60
Extremely Long	70

[27] http://www.ncasi2.org/COLE/. After opening, zoom into project area on map and follow instructions to "get plots within this radius…". Once the data has been retrieved, the report can be obtained following the instructions on the site.

6.2.2.2 Adjust for Legal Constraints

The baseline must exceed all legal constraints. A determination must be made whether the legal constraints that affect forest management within the Project Area require further adjustments to the initial baseline developed above, using the following steps:

1. Identify legal constraints affecting the Project Area.
    a. Identify and describe the legal requirements affecting the Project Area.
    b. Spatially identify (map) the areas to which the legal requirements apply within the Project Area to determine the affected acres.
2. Determine forest structure needed to comply with the legal requirements.
    a. Describe the forest structure needed to ensure compliance with the legal requirements affecting each area.
    b. Explain and justify the forest conditions and associated age class that meets the forest conditions identified for meeting the minimum criteria of the legal requirement. In no case shall the age class be less than the age class associated with the rotation length from Table 6.3.
3. Adjust baseline values.
    a. Use the live and dead tree values associated with the age class from the COLE 1605(b) report that is associated with the previous step. The 100-year values for live and dead trees in the COLE 1605(b) report shall be used in cases where determinations of forest structure are not easily justified.
    b. Develop a weighted average by multiplying the acres for each constraint class by the COLE 1605(b) values and dividing by the total acres to determine the adjusted baseline.

6.2.2.3 Estimate the Project's Baseline Harvest Volume

The estimate of baseline harvest volume shall be determined by multiplying the adjusted baseline (above) by 3%. The resulting volume shall be used in conjunction with the guidance in Appendix B to determine harvested wood products. The harvest volume shall remain constant for the project life.

6.2.2.4 Determining the Final Project Baseline

The final baseline is determined by adding the estimated harvested wood products to the adjusted baseline.

6.2.3 Determining Actual Onsite Carbon Stocks

Actual carbon stocks for Improved Forest Management Projects must be determined by updating the Project Area's forest carbon inventory. This is done by:

1. Incorporating any new forest inventory data obtained during the previous year into the inventory estimate. Any plots sampled during the previous year must be incorporated into the inventory estimate.

2. Using an approved model or a stand table projection to "grow" (project forward) prior- year data from existing forest inventory plots to the current reporting year. Guidance for projecting forest inventory data is identified in Appendix B.
3. Updating the forest inventory estimate for harvests and/or disturbances that have occurred during the previous year. To allow some flexibility in updating the forest inventory during onsite verification years, a project may defer updating a small percentage of plots until the following reporting period, as detailed in Appendix B. This will help streamline the sequential sampling process when recent disturbances have taken place.
4. Applying an appropriate confidence deduction for the inventory based on its statistical uncertainty, following the guidance in Appendix B.

6.2.4 Determining Actual Carbon in Harvested Wood Products

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

1. Determine the actual amount of carbon in standing live and carbon stocks (prior to delivery to a mill) harvested in the current year (based on harvest volumes determined in Section 6.2.3).
2. Determine the amount of actual harvested carbon that will remain stored in wood products, averaged over 100 years, following the requirements in Appendix B.

6.2.5 Quantifying Secondary Effects

For Improved Forest Management 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 protocol because the emission reductions are accounted for by the energy sector.

The risk that Secondary Effects may be occurring is calculated in this protocol. However, the magnitude of risk of Secondary Effects is dependent on how much harvesting occurs on the Project Area relative to the baseline scenario. This protocol uses a conservative default 40% market leakage rate for IFM projects[2]. This protocol considers the impacts of shifting harvest activities over the project life. As discussed above, since the baseline is a representative scenario of legally permissible and financially feasible growth and harvesting regimes in the absence of a project, baseline pools, including those used to quantify the risk of Secondary Effects, are averaged across the baseline period (i.e., 100 years). The risk of Secondary Effects for the project are thus considered in relation to such averaged baseline harvesting. Improved Forest Management 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. However, this SSR must be reported annually due to the risk that Secondary Effects may be occurring in any given year.

Equation 6.5 must be used to estimate the Secondary Effects risk for Improved Forest Management Projects. Recognizing that Secondary Effects from projects may be influenced by long term harvesting trends, the evaluation in Equation 6.5 considers how actual cumulative harvest amounts vary from baseline cumulative harvest amounts since project inception.

When baseline cumulative harvested carbon exceeds actual cumulative harvested carbon - *but actual onsite harvested carbon exceeds the baseline amount in a given reporting period* - net

[2] Carbon leakage in energy/forest sectors and climate policy implications using meta-analysis - ScienceDirect

GHG reductions are increased (Equation 6.5.B). This allows for prior deductions for Secondary Effects to be recouped, because the risk has been lowered. However, once actual cumulative harvest amounts exceed baseline cumulative harvest amounts, Secondary Effects risk is zero and will remain zero for as long as actual cumulative harvest amounts exceed baseline cumulative harvest amounts (Equation 6.5.A). Under no circumstances shall the net balance of Secondary Effects offsets over the course of a project be positive. However, maintaining actual cumulative harvest above baseline cumulative harvest will allow a project to accrue any uncredited positive carryover that can counteract the amount of future Secondary Effects deductions that would be applied if baseline cumulative harvested carbon were to exceed actual harvested carbon again (Equation 6.5.C). Refer to Appendix B for an example of how Secondary Effects are evaluated over time, and how prior Secondary Effects may be recouped.

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

Equation 6.5. Secondary Effects Emissions

Equation 6.5.A:

$$If \sum_{n=1}^{y}\left(AC_{hv,n} - BC_{hv,n}\right) \geq 0, and \sum_{n=1}^{y-1} SE_{as,n} \geq 0,$$
$$then\, SE_{as,y} = 0^{\dagger}$$

Equation 6.5.B:

$$If \left(\sum_{n=1}^{y}\left(AC_{hv,n} - BC_{hv,n}\right) < 0 \; and \sum_{n=1}^{y-1} SE_{as,n} < 0\right) or \left(\sum_{n=1}^{y}\left(AC_{hv,n} - BC_{hv,n}\right) \geq 0 \; and \sum_{n=1}^{y-1} SE_{as,n} < 0\right)$$
$$then\, SE_{as,y} = MIN\left(\left(AC_{hv,y} - BC_{hv,y}\right) \times 40\% \left|\sum_{n=1}^{y-1} SE_{as,n}\right|\right.$$

Equation 6.5.C:

$$If \left(\sum_{n=1}^{y}\left(AC_{hv,n} - BC_{hv,n}\right) < 0, and \sum_{n=1}^{y-1} SE_{as,n} \geq 0\right),$$
$$then\, SE_{as,y} = MIN\left(\sum_{n=1}^{y-1} SE_{as,n} + \left(\left(AC_{hv,y} - BC_{hv,y}\right) \times 40\%\right), 0\right)^{\dagger}$$

Where,			Units
$SE_{as,y}$	=	Estimated annual Secondary Effects in current reporting period *y* (used in Equation 6.1)	tCO_2e
$SE_{as,n}$	=	Estimated annual Secondary Effects in reporting period *n*	tCO_2e
$AC_{hv,n}$	=	Actual amount of onsite carbon harvested in reporting period *n* (prior to delivery to a mill)	tCO_2e
$BC_{hv,n}$	=	Estimated average baseline amount of onsite carbon harvested in reporting period *n* (prior to delivery to a mill), as determined above	tCO_2e

$AC_{hv,y}$	=	Actual amount of onsite carbon harvested in current reporting period *y* (prior to delivery to a mill)	tCO_2e
$BC_{hv,y}$	=	Estimated average baseline amount of onsite carbon harvested in current reporting period *y* (prior to delivery to a mill), as determined in Section 6.2.1.4, 6.2.1.9, or 6.2.3.3 as applicable	tCO_2e

† Secondary Effects are not awarded offsets but may accrue as positive carryover. Annual accruals are calculated in the same way that Secondary Effects are calculated when baseline cumulative harvested carbon exceeds actual harvested carbon. Cumulative Secondary Effects as of the current reporting period are calculated by the following: $\sum_{n=1}^{y} \boldsymbol{SE_{as,n}} = \sum_{n=1}^{y-1} \boldsymbol{SE_{as,n}} + \left(\left(\boldsymbol{AC_{hv,y}} - \boldsymbol{BC_{hv,y}}\right) \times \mathbf{40}\%\right)$.
Positive carryover reduces or negates future Secondary Effects deductions.

6.3 Avoided Conversion Projects

6.3.1 Estimating Baseline Onsite Carbon Stocks

The baseline for Avoided Conversion Projects is a projection of onsite forest carbon stock losses that would have occurred over time due to the conversion of the Project Area to a non- forest land use. Estimating the baseline for Avoided Conversion Projects involves two steps:

1. Characterizing and projecting a baseline
2. Adjusting the baseline based on conversion risk

Step 1 – Characterizing and Projecting the Baseline

Project Operators must characterize and project the baseline by:

1. Clearly specifying an alternative highest-value land use for the Project Area, as identified by appraisals (required by this protocol). The appraisals must include accompanying documentation that demonstrates the type of anticipated land use conversion is legally permissible. Such documentation must fall into at least one of the following categories:
   a. Documentation indicating that the current land use policies, including zoning and general plan ordinances, and other local and state statutes and regulations, permit the anticipated type of conversion.
   b. Documentation indicating that the Project Operator has obtained all necessary approvals from the governing county to convert the Project Area to the proposed type of non-forest land use (including, for instance, certificates of compliance, subdivision approvals, timber conversion permits, other rezoning, major or minor use permits, etc.).
   c. Documentation indicating that similarly situated forestlands within the project's Assessment Area were recently able to obtain all necessary approvals from the governing county, state, or other governing agency to convert to a non-forest land use (including, for instance, certificates of compliance, subdivision approvals, timber conversion permits, other rezoning, major or minor use permits, etc.).
2. Estimating the rate of conversion and removal of onsite standing live and dead carbon stocks. The rate of conversion and removal of onsite standing live and dead carbon stocks must be estimated by either:

a. Referencing planning documentation that has been approved and permitted by the appropriate planning department for the Project Area (e.g., construction documents or plans) that specifies the timeframe of the conversion and intended removal of forest cover on the Project Area; or
b. In the absence of specific documentation, identifying a default annual conversion rate for carbon in standing live and dead carbon stocks from Table 6.4. The default value is subject to any legal constraints, which must be incorporated in modeling the project's baseline.

Table 6.4. Default Avoided Conversion Rates for Standing Live and Dead Carbon Stocks

Type of Conversion Identified in Appraisal	Total Conversion Impact	Annual Rate of Conversion
	This is the assumed total effect over time of the conversion activity on standing live and dead carbon stocks. (The total conversion impact is amortized over a 10-year period to determine the annual rate of conversion in the next column.)	This is the assumed annual rate of the conversion activity on standing live and dead carbon stocks. The percentages below are multiplied by the initial standing and dead carbon stocks for the project on an annual basis for the first 10 years of the project.
Residential	Estimate using the following formula: *TC*% = (min(1,(*P**3) / *PA*)) *Where,* *TC* = % total conversion (*TC* cannot exceed 100%) *PA* = the Project Area (acres) identified in the appraisal *P* = the number of unique parcels that would be formed on the Project Area as identified in the appraisal * Each parcel is assumed to deforest 3 acres of forest vegetation	Estimate using the following formula: *ARC* = *TC* / 10 *Where,* *ARC* = % annual rate of conversion *TC* = % total conversion
Mining and Agricultural Conversion, including Pasture or Crops	90%	9.0%
Golf Course	80%	8.0%
Commercial Buildings	95%	9.5%

A computer simulation, based on 2a or 2b above, must be conducted to project changes in onsite standing live and dead carbon stocks over 100 years. The computer simulation of the onsite standing live and dead carbon stocks must approximate the identified rate of conversion over time to estimate changes in standing live and dead carbon stocks, beginning with the Project Area's initial onsite standing live and dead carbon stocks. If the projected conversion rate does not result in a complete removal of onsite standing live and dead carbon stocks, the baseline projection must account for any residual forest carbon value as a steady condition for the balance of a 100-year projection.

The carbon stock trends for standing live carbon and standing dead carbon are added together to determine a project baseline for the onsite carbon stocks. Figure 6.5. displays a simplified view of the baseline trend of onsite carbon stocks, as well as the basis for project crediting over time.

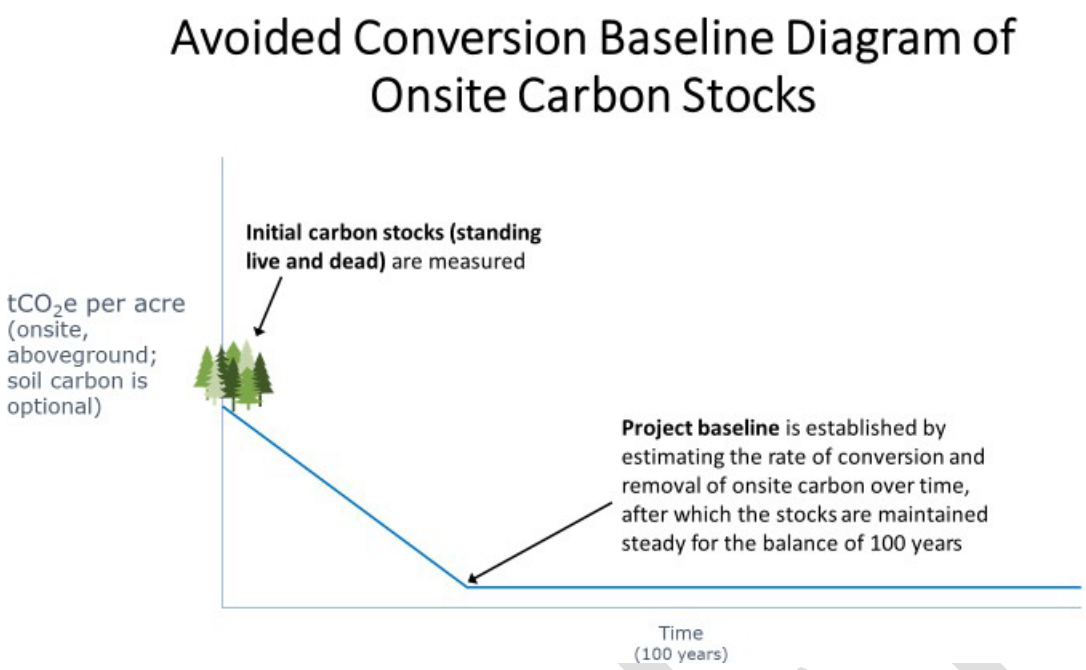


Figure 6.5. Example of an Avoided Conversion Project Baseline

Step 2 – Adjusting the Baseline Based on Conversion Risk

If the fair market value of the anticipated alternative land use for the Project Area (as determined by the lower of the two required appraisals is *not more than 80 percent greater* than the value of the current forested land use, then the baseline must be adjusted to reflect uncertainty about the risk of conversion. If the project utilizes multiple appraisals to cover the entire Project Area, the appraisals must all result in the same Conversion Risk Adjustment Factor to be considered for use in the same project.

Equation 6.6. Conversion Risk Adjustment Factor

If $0.4 < ((VA / VP) - 1) < 0.8$, **then** $CRA = [80\% - ((VA / VP) - 1)] \times 2.5$
If $((VA / VP) - 1) \geq 0.8$, **then** $CRA = 0\%$
If $((VA / VP) - 1) \leq 0.4$, **then** $CRA = 100\%$

Where,

CRA	=	Conversion Risk Adjustment factor
VA	=	Appraised fair market value of the anticipated alternative land use for the Project Area
VP	=	Appraised fair market value of the current forested land use for the Project Area

The baseline is adjusted by applying the Conversion Risk Adjustment factor to the unadjusted baseline determined in Step 1, using Equation 6.7 below.

Equation 6.7. Adjusted Baseline Onsite Carbon Stocks

$$BC_{onsite,y} = BLU_y + (IS - BLU_y) \times CRA$$

Where,			Units
$BC_{onsite,\ y}$	=	Adjusted baseline onsite carbon stocks in year *y*, for each of the 100 years calculated in the project's baseline	tCO_2e
BLU_y	=	Unadjusted baseline onsite carbon stocks in year *y*, for each of the 100 years calculated in the project's baseline (determine in Step 1, above)	tCO_2e
IS	=	Initial onsite carbon stocks at the project start date	tCO_2e
CRA	=	Conversion Risk Adjustment factor, as described above	%

6.3.2 Estimating Baseline Carbon in Harvested Wood Products

Harvesting is assumed to occur in the baseline over time as the Project Area is converted to another land use. To estimate the baseline carbon transferred to long-term storage in harvested wood products each year:

1. Determine the amount of carbon in standing live carbon stocks (prior to delivery to a mill) that would have been harvested in each year, consistent with the rate of reduction in baseline standing live carbon stocks determined in Section 6.3. This projection is determined at the project outset, using the same biomass equations used to calculate biomass in live trees, and will not change over the course of the project.
2. On an annual basis, determine the amount of harvested carbon that would have remained stored in wood products, averaged over 100 years, following the requirements in Appendix B.

6.3.3 Determining Actual Onsite Carbon Stocks

Actual carbon stocks for Avoided Conversion Projects must be determined by updating the Project Area's forest carbon inventory. This is done by:

1. Incorporating any new forest inventory data obtained during the previous year into the inventory estimate. Any plots sampled during the previous year must be incorporated into the inventory estimate.
2. Using an approved model to "grow" (project forward) prior-year data from existing forest inventory plots to the current reporting year. Approved growth models are identified in Appendix B. Guidance for projecting forest inventory plot data using models is also provided in Appendix B.
3. Updating the forest inventory estimate for harvests and/or disturbances that have occurred during the previous year. To allow some flexibility in updating the forest inventory, a project may defer updating a small percentage of plots until the following reporting period, as detailed in Appendix B.
4. Applying an appropriate confidence deduction for the inventory based on its statistical uncertainty, following the guidance in Appendix B.

6.3.4 Determining Actual Carbon in Harvested Wood Products

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

1. Determine the actual amount of carbon in standing live and dead carbon stocks (prior to delivery to a mill) harvested in the current year (based on harvest volumes determined in Section 6.3.2).
2. Determine the amount of actual harvested carbon that will remain stored in wood products, averaged over 100 years, following the requirements in Appendix B.

6.3.5 Quantifying Secondary Effects

Significant Secondary Effects for Avoided Conversion Projects can arise if the type of land use conversion that would have happened on the Project Area is shifted to other forest land.

To quantify Secondary Effects risk for Avoided Conversion Projects, Project Operators must quantify Secondary Effect emissions risk using Equation 6.16. The value for Secondary Effect emissions will always be negative or zero.

Equation 6.8. Secondary Effects Emissions Risk

$$SE_{as,y} = (-1) \times 3.6\% \times (\Delta AC_{onsite} - \Delta BC_{onsite}) \text{ or } 0, \text{ whichever is lower}$$

Where,			Units
$SE_{as,y}$	=	Secondary Effect GHG emissions that may result from activity shifting outside the project area, as a result of the project activity in year *y* (Equation 6.1)	tCO_2e
ΔAC_{onsite}	=	Annual difference in actual onsite carbon as defined in Equation 6.1	tCO_2e
ΔBC_{onsite}	=	Annual difference in baseline onsite carbon as defined in Equation 6.1	tCO_2e

7 Project Monitoring

This section provides requirements and guidance on project monitoring, reporting rules and procedures.

7.1 Project Documentation

Project Operators must provide all required documentation to the approved offset project registry to submit a forest project for listing, in accordance with WAC 173-446-520. Required documentation includes:

- Project listing form
- Ownership interest documentation, as needed (see Section 2.2)
- Shapefile and KML files of the Project Area

Project Operators must provide the following documentation to the approved offset project registry to register a project.

- Offset project data report form
- Verification Report
- Verification Statement
- Supplemental documentation as requested by the approved offset project registry

Project Operators must provide the following documentation each time a Forest Project is verified in order for Ecology to issue offsets for quantified GHG reductions.

- Monitoring report
- Calculation worksheet
- Verification Report
- Verification Statement
- Request of Issuance of Ecology Offset Credits
- Conservation Easement (if one is employed)
- Supplemental documentation as requested by Ecology

Project submittal forms can be found on Ecology's website.

All reports that reference carbon stocks must be submitted with the oversight of a Professional Forester, for jurisdictions with a Professional Forester law or regulation, or a Certified Forester, managed by the Society of American Foresters (see www.certifiedforester.org) so that professional standards and project quality are maintained. Any Professional Forester or Certified Forester preparing a project in an unfamiliar jurisdiction must consult with a Professional Forester or Certified Forester practicing forestry in that jurisdiction to understand all laws and regulations that govern forest practice within the jurisdiction. Ecology may evaluate and approve alternative certification credentials if requested, but only for jurisdictions where professional forester laws or regulations do not exist. 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.

7.1.1 Offset Project Data Report

The Offset Project Operator or Authorized Project Designee must submit Offset Project Data Reports according to the reporting schedule in WAC 173-446-525. A forest project is

considered automatically terminated if the Offset Project Operator or Authorized Project Designee does not report data at required intervals.

The listing information in section 7.1 must be included in the initial Offset Project Data Report, and is subject to verification at the initial and all subsequent offset project verifications. Reforestation projects defer an initial inventory, as described in section 6.1.1, until submission of the Offset Project Data Report that will undergo the second site-visit verification. Reforestation projects for which an initial inventory is deferred are not eligible to receive Ecology or registry offset credits until after the second verification. All documents that reference carbon stocks must be submitted with the oversight of a Professional Forester. If the offset project is located in a jurisdiction without a Professional Forester law or regulation, then a Professional Forester must either have the Certified Forester credentials managed by the Society of American Foresters, or other valid professional forester license or credential approved by a government agency in a different jurisdiction.

The Offset Project Operator or Authorized Project Designee must provide the Offset Project Data Report(s) undergoing verification to a verification body at least ten working days prior to the start of any scheduled verification site visit.

7.2 Monitoring Report

Monitoring is the process of regularly collecting and reporting data related to a project's performance. Annual monitoring of Forest Projects is required to ensure up-to-date estimates of project carbon stocks and provide assurance that GHG reductions or removals achieved by a project have not been reversed. Project Operators must conduct monitoring activities and submit monitoring reports according to the schedule and requirements presented in Section 8.3. Monitoring is required for a period of 100 years following the final issuance of offsets to a project for quantified GHG reductions or removals.

For Forest Projects, monitoring activities consist primarily of updating a project's forest carbon inventory, entering the updated inventory into the Forest Project's Calculation Worksheet, and submitting it to the approved offset project registry at frequencies defined in Section 7.3. Offsets are only issued in years that the project data are verified, as described in Section 8

A monitoring report must be prepared for each Reporting Period. Monitoring reports must be provided to verification bodies whenever a Forest Project undergoes verification. In addition, monitoring reports must be provided to the approved offset project registry upon the completion of any Reporting Period for which verification will be deferred (e.g., if the Project Operator foregoes a desk-review verification). All monitoring reports are due within 12 months of the end of the Reporting Period. Monitoring reports must include an update of the project's calculation worksheet. Reforestation Projects, as described in Section 6, can defer the items that are marked with an asterisk until the second site visit verification. The project's calculation worksheet includes:

1. An updated estimate of the current year's carbon stocks in the reported carbon pools. Specific methods used to update the forest inventory must follow the inventory methodology approved at the time the project is registered. Modifications to inventory methodologies must be approved in advance by the Ecology and the approved offset project registry. Any changes in inventory estimates associated with the use of the modified inventory methodology will need to be reconciled with previously verified project inventory estimates and baseline projections. The updated estimate of carbon stocks is determined by:
    a. Including any new forest inventory data obtained during the Reporting Period.
    b. *Applying growth estimates to existing inventory.

c. Updating inventory estimates for harvest and/or disturbances that have occurred during the Reporting Period.

2. *The appropriate confidence deduction for the forest carbon inventory, as determined at the last full site visit verification for the project (following Appendix B). The same confidence deduction must be used in interim years between verification site visits.
3. *An estimate of current-year harvest volumes and associated carbon in harvested wood products.
4. *Estimated mill efficiency, as determined following the guidance in Appendix B.
5. *The baseline carbon stock estimates for all required and optional carbon pools for the current year, as determined following the requirements in Section 6 and approved at the time of the project's registration.
6. An estimate of Secondary Effects, following calculation steps and/or factors provided in Section 6 and approved at the time of the project's registration.
7. The uncertainty discount for Avoided Conversion Projects, as determined following the requirements of Section 6.3 and approved at project registration. (Once a project is registered with the approved offset project registry, the uncertainty discount does not change.)
8. *A preliminary calculation of total net GHG reductions and removals (or reversals) for the year, following the requirements in Section 6.
9. *The project's reversal risk rating, as determined following the requirements in Appendix A. The risk rating is updated during each full site visit verification. Between verification site visits, the project's reversal risk rating does not change.
10. *A preliminary calculation of the project's Buffer Pool contribution.

In addition to data reported using the project calculation worksheet, the following must be submitted to the approved offset project registry as part of a monitoring report.

For each Reporting Period:

1. A description of how the project meets (or will meet) the definition of Natural Forest Management (refer to Section 3.6.2), including progress on criteria that have not been fully met in previous years.
2. An updated estimate of canopy cover across the Project Area. Estimates may be conducted using recent satellite images from within the last year.

Conditional reporting, as pertinent:

1. *An explanation for any decrease over any ten-year consecutive period in the standing live carbon pool.
2. Any changes in the status of the Project Operator including, if applicable per Section 3.4, the acquisition of new forest landholdings.
3. If a reversal has occurred during the previous year, the report must provide a written description and explanation of the reversal, whether the approved offset project registry classified the reversal as Intentional or Unintentional, and the status of compensation for the reversal.

7.2.1 Reporting Period Duration and Cycle

A Reporting Period is a discrete period of time for which a Project Operator quantifies and reports GHG reductions and removals, as well as required project data to the approved

offset project registry. The initial Reporting Period may cover any length of time, up to one year. Reporting Periods subsequent to the initial Reporting Period must cover 12 months of project activity. Reporting Periods include those 12-month periods following the completion of the project's crediting period and during which ongoing monitoring and verification is required to ensure the permanence of those offsets issued to the project. Reporting Periods must be contiguous, i.e., there must be no gaps in reporting during the crediting period of a Forest Project once the project has begun receiving offsets.

7.2.2 Verification Cycle

The Verification Period is the period of time for which GHG emissions reductions and/or removals from project activities are verified and credits are issued. A Verification Period may include multiple Reporting Periods. The end date of any Verification Period must correspond to the end date of a Reporting Period. The initial verification must cover the initial Reporting Period and may also include the second reporting period, for a maximum of a 24-month initial Verification Period. The initial verification of all project types is intended to confirm the project's eligibility, and confirm that the project's initial inventory and the baseline have been established in conformance with the FP. [29]

Verification is required at specific maximum intervals to ensure that ongoing monitoring of forest carbon stocks, inventory confidence, and risk ratings are accurate and up to date. Optional verification is at the Project Operator's discretion and may be conducted between required verifications for crediting (non-aggregated projects), to adjust the project's confidence estimate and/or risk ratings, among other rationale, based on changed management circumstances.

Submission of annual monitoring reports to the approved offset project registry is required even if the Project Operator chooses to forego an optional verification. The schedule of required verification is dependent upon the project type and whether the project is aggregated or non-aggregated. Details of verification scheduling requirements are provided in Table 8.1.

Verification must be completed within 12 months of the end of the Reporting Period(s) being verified. For required verifications, failure to complete verification within the requisite time period will result in account activities being suspended until the verification is complete. If a project does not meet the initial verification deadline, the project's start date may be impacted. The project will terminate if the required verification is not completed within 36 months of the end of the Reporting Period(s) being verified. There is no consequence for failure to complete verification activities within 12 months for optional verifications.

[29] Reforestation projects may defer the initial inventory and baseline determination until the second site visit verification.

7.2.2.1 Site Visit and Desk Review Verification Schedule

Refer to the table below for minimum required site visit schedules, optional desk reviews, and any exceptions to the minimum requirements by project type.

Table 7.1. Forest Project Verification Schedule

Aggregation	Project Type	Verification Type	Required Timing
All	All Forest Projects	Initial verification of the first Verification Period (with or without site visit, as detailed below)	Must be completed within 12 months of the end of the Reporting Period(s) being verified.
All	All Forest Projects	All verifications (full site visit verifications, and desk reviews, including the initial verification)	Must be completed within 12 months of the end of the Reporting Period(s) being verified
Non-aggregated	All Forest Projects	Site Visit	Required for initial verification
			Required for the verification following the end of every 6th Reporting Period thereafter, unless one of the exceptions below are applicable (for under 4,000 offset credits/year, or no offsets in a given year), and for the second verification for Reforestation projects for which the Project Operator has deferred the second verification, which may be deferred indefinitely at the Project Operator's discretion.
		Desk Review	Optional, between required site visit years. However, desk review verifications are not permitted for

Aggregation	Project Type	Verification Type	Required Timing
			Reforestation Projects between the initial and second site visit verifications if the Project Operator has opted to defer the second verification.
	Any Forest Project receiving under 4,000 offsets/year[30]	Site Visit	Required for the verification following the end of every 12th Reporting Period after a site visit verification has taken place, or once 48,000 offsets have been accumulated across the unverified Reporting Periods.[31] If the Ecology has reason to believe that a project proponent has been reporting artificially low numbers to take advantage of this option, the Ecology will require the project to revert to the 6 year site visit cycle.[32]
		Desk Review	Optional, between required site visit years
	Any Forest Project not seeking offsets by the time a site visit is required	Desk Review	If a forest project opts not to receive additional offsets during a normal site visit year and has not experienced a reversal, they must undergo a desk review of the monitoring reports submitted since the last verification. If canopy cover has declined on the project area by more than 5%, then the project must be evaluated for a potential reversal and a site visit may be required as described in WAC 173-446-570. Reporting periods evaluated as part of this type of desk review are considered to be part of the project crediting period, even though credits are not sought. This type of verification cannot be used in the last year of a project's crediting period.[33]

[30] The 4,000 offset/year threshold will be assessed as an average of the reported annual gross offsets (including buffer pool credits) since the last site visit.

[31] When the 48,000 offset threshold is met, a site visit will be required after the following reporting period. For example, if the threshold is met during reporting period 7, a site visit will be required following reporting period 8.

[32] "Artificially low numbers" will be assessed based on the verifier's review of quantitative materiality. If the project experiences an intentional reversal, then it will not be eligible for the 12-year verification cycle and will revert to following the 6-year verification cycle until the completion of the next site visit.

[33] This option is not possible in the project's final year because certain aspects of project quantification (like leakage) are assessed over the 100-year time frame of the project. A verification is required in the final year in order to true-up this quantification and ensure the project has not been over-credited.

Aggregation	Project Type	Verification Type	Required Timing
Aggregated	All Forest Projects	Site Visit	Refer to *Guidelines for Aggregating Forest Projects [Appendix C]*
		Desk Review	Refer to *Guidelines for Aggregating Forest Projects [Appendix C]*
All	All Forest Projects that experience reversal or choose to update reversal risk rating	Site Visit	Required any time the Project Operator would like to establish new confidence deductions and/or reversal risk ratings, except when confidence deduction changes as a result of a project joining an aggregate
			Required to be completed within one year of notifying Ecology of an intentional reversal, when the threshold in WAC 173-446-570 is met
			Required to be completed within 2 years of Ecology of an unintentional reversal
		Desk Review	Required to be completed within one year of notifying the Ecology of an intentional reversal, unless the threshold in WAC 173-446-570 is met
All	All Forest Projects after crediting period has ended but during period required for permanence monitoring	Desk Review	Required following the end of every 6th Reporting Period after the final verification is completed at the end of the project's crediting period, until all permanence monitoring obligations have been met (i.e., 100 years after the last offset issuance). A desk review of the monitoring reports submitted since the last verification is required. If canopy cover has declined on the project area by more than 5%, then the project must be evaluated for a potential reversal and a site visit may be required as described in WAC 173-446-570

7.3 Record Keeping

For purposes of independent verification and historical documentation, Project Operators are required to keep all documents and forms related to the project for a minimum of 100 years after the final issuance offsets by Ecology. This information may be requested by the verification body, the approved offset project registry, or Ecology at any time.

7.4 Transparency

Ecology requires data transparency for all Forest Projects, including data that displays current carbon stocks, reversals, and verified GHG reductions and removals. For this reason, all non-confidential project data reported to the approved offset project registry will be publicly available on the registry's website.

8 Verification Guidance

This section provides guidance to Ecology-approved verification bodies for verifying GHG emission reductions associated with a planned set of activities to remove, reduce or prevent CO_2 emissions in the atmosphere by conserving and/or increasing forest carbon stocks. Verification requirements are established in WAC 173-446-530 and WAC 173-446-535.

8.1 Standard of Verification

This section of the protocol provides requirements and guidance for the verification of projects associated with the three Forest Project types defined in Section 2. All three project types involve planned activities that result in conserving and/or increasing forest carbon stocks. This section describes the core verification activities and criteria for each of the three Forest Project types that are necessary for a verification body to provide a reasonable level of assurance that the GHG removals or reductions quantified and reported by Project Operators are materially correct.

Verification bodies will use the criteria in this section to determine if there exists reasonable assurance that the data submitted on behalf of the Project Operator to the approved offset project registry and Ecology addresses each requirement in the FP, Sections 2 through 7. Project reporting is deemed accurate and correct if the Project Operator is in compliance with the Section 2 through 7.

8.2 Emission Sources, Sinks, and Reservoirs

For all verification activities, verification bodies review a project's reported sources, sinks, and reservoirs to ensure that all are identified properly and to confirm their completeness. Table 5.2 and Table 5.3 in Section 5 provide comprehensive lists of all GHG sources, sinks, and reservoirs that must be included in the quantification and reporting of GHG reductions and removals for the three Forest Project types.

It is the Project Operator's responsibility to ensure that verifications are conducted according to the minimum required schedule specified in Section 7.2.2. A Verification Report, List of Findings, and Verification Statement must be submitted within twelve months of the end of any verification period. Site visit verification requirements are described in Section 8.3.2. Desk review verification requirements are described in Section 8.3.3.

8.3 Project Verification Activities

Required verification activities for Forest Projects will depend on whether the verification body is conducting an initial verification for registration with Ecology, a minimum required verification involving a site visit, or an optional annual verification involving a desk review. Both the initial verification and ongoing verifications must include review of the criteria for Natural Forest Management, inventory of onsite carbon stocks, assessment of carbon in harvested wood products, and review of reversal risk ratings. The following sections contain

guidance for all of these verification activities.

8.3.1 Initial Verification

Initial verification includes verification that the Forest Project has met the FP criteria and requirements for eligibility, Project Area definition, modeling baseline onsite carbon stocks, and calculating baseline carbon in harvested wood products. The initial verification must include a site visit. The verification body must assess and ensure the completeness and accuracy of all required reporting elements for the Offset Project Data Report (Section 7.1.1). Initial verification items are presented in Table 8.1A through 8.1K.

At a Forest Project's initial verification, these items must be verified in addition to all the items required for a standard site visit verification, as detailed in Section 8.3.2.

8.3.1.1 Initial Eligibility

Verification bodies are required to affirm the project's eligibility according to the rules in this protocol. Tables 8.1A, 8.1B, and 8.1C provide the initial verification items concerning eligibility for the three different Forest Project types and include references to sections of this protocol where requirements are further specified.

Table 8.1A. Initial Eligibility Verification Items – Reforestation Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Project Definition	a. Evidence exists of canopy cover < 10% for 10 years, and of historical forest cover or appropriateness of site for native forest establishment, or b. Evidence of significant disturbance provided. c. No evidence exists for use of broadcast fertilization.	2.1.1	Yes
2. Legal Requirement Test	Proof that the project proponent has completed the required attestations in WAC 173-446-520	3.3.1.1	No
3. Performance Test	The project that occurs on land that has had ten percent or less tree canopy cover for at least ten years or occurs on land that has undergone a Significant Disturbance within the past 10 years and decreased the live tree canopy cover below 25 percent.	3.3.2.1	No
4. Start Date	Identification of the date on which tree planting occurred or will occur, site preparation for the planting of trees occurred or will occur, or removal of impediments to natural regeneration occurred or will occur (whichever was or will occur first).	3.2	No

5. Project Location	a. Project is in the United States of America or one of the Territories (Reforestation and Avoided Conversion only). b. Project is on private land, or c. If non-federal public lands, provide documentation showing approval by the government agency or agencies responsible, or d. If tribal land, provide documentation that demonstrates that the land within the Project Area is owned by a tribe or private entities. e. If on a location where activities associated with another project type occur, Project Operator has obtained approval and adhered to any guidance from Ecology or the approved offset project registry	3	No

Table 8.1B. Initial Eligibility Verification Items – Improved Forest Management Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Project Definition	a. Evidence is provided indicating the canopy cover exceeds 10%. b. No evidence exists for use of broadcast fertilization.	2.1.2	Yes (for 1.b)
2. Legal Requirement Test	Proof that the project proponent has completed the required attestations in WAC 173-446-520	3.3.1.2	No
3. Start Date	Identification of a discrete, verifiable action that delineates a change in practice relative to the project's baseline.	3.2	No
4. Project Location	a. Project is located in the United States of America. b. Project is on private land, or c. If non-federal public lands, provide documentation showing approval by the government agency or agencies responsible, or d. If tribal land, provide documentation that demonstrates that the land within the Project Area is owned by a tribe or private entities. e. If on a location where activities associated with another project type occur, Project Operator has obtained approval and adhered to any guidance from Ecology.	3	No

Table 8.1C. Initial Eligibility Verification Items – Avoided Conversion Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Project Definition	a. Proof that the project is/was on private land prior to project initiation. b. Proof that a conservation easement was recorded, or the land was transferred to public ownership. c. Demonstration that conversion out of forest is a significant risk (following the requirements of Section 6.3 – see also Table 8.1H). d. No evidence exists for use of broadcast fertilization.	2.1.3, 6.3	Yes (for 1.c and 1.d)
2. Legal Requirement Test	a. Proof that the project proponent has completed the required attestations in WAC 173-446-520 b. Documentation has been provided that demonstrates that the type of land use conversion anticipated by the project is legally permissible; documentation must fall into at least one of the three categories specified in Section 3.3.1.3.	3.3.1.3	No
3. Performance Test	Copy of real estate appraisal(s) for the Project Area indicating conformance to criteria in Section 3.3.2.3.	3.3.2.3	No
4. Start Date	Identification of date on which one of the following occurred: • A conservation easement with a minimum term length extending 100 years beyond final offset issuance and that dedicates the Project Area to continuous forest cover was recorded. • The project was submitted to the approved offset project registry for listing, and a conservation easement with a minimum term length of 100 years beyond final offset issuance and that dedicates the Project Area to forest cover has been recorded prior to the completion of verification or has been drafted and will be recorded prior to registration of the project. • The Project Area was transferred to public ownership.	3.2, 3.5	No
5. Project Location	a. Project is located in the United States of America. b. Project is on private land, or c. If non-federal public lands, provide documentation showing approval by the government agency or agencies responsible, or	3	No

Verification Items		Section of FP	Apply Professional Judgment?
	d. If tribal land, provide documentation that demonstrates that the land within the Project Area is owned by a tribe or private entities. e. If on a location where activities associated with another project type occur, Project Operator has obtained approval and adhered to any guidance from Ecology.		

8.3.1.2 Project Area Definition

Verification bodies are required to review the geographic boundaries defining the Project Area and their compliance with the requirements outlined in Section 4 of this protocol. These items are verified only at the project's initiation.

Table 8.1D. Project Area Definition Verification Items

Project Type	Verification Items	Section of FP	Apply Professional Judgment?
1. All	Proof that a description, shapefile, KML file, and maps of the geographic boundaries defining the Project Area are on file with the approved offset project registry. For Reforestation projects, the initial Project Area may be provisional until the second site visit verification in cases where the inventory has been deferred.	4, 7	No
2. Avoided Conversion	Project Area has been defined following the guidance in Section 4, Table 4.1 for the appropriate conversion type.	4	No

8.3.1.3 Baseline Onsite Carbon Stocks

Verification bodies are required to confirm that the Project Operator has developed a baseline characterization for onsite carbon stocks according to the requirements in this protocol. These items are verified only at the project's initiation.

Table 8.1E. Baseline Estimation Verification Items – Reforestation Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Qualitative Characterization	Clear qualitative characterization of vegetative conditions and activities that would have occurred without the project.	6.1.1	Yes

Verification Items		Section of FP	Apply Professional Judgment?
2. Inventory of Onsite Carbon Stocks	a. An inventory of the Project Area's carbon stocks in required and optional pools has been conducted in accordance with the requirements of the FP (see Section 8.3.5 for further verification guidance). b. The inventory of carbon stocks has been deferred until the second site visit verification.	6.1.1, Appendix B	Yes
3. Baseline Carbon Stock Modeling	a. A computer simulation has been conducted that models the carbon stocks in accordance with the requirements and guidance in Section 6.1.1 and Appendix B (see Section 8.3.6 for further verification guidance), or b. The computer simulation has been deferred until the project's second site visit verification.	6.1.1, Appendix B	Yes
4. Description of Forest 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.	2	No

Table 8.1F. Baseline Estimation Verification Items – Improved Forest Management Projects – Private Lands

Verification Items		Section of FP	Apply Professional Judgment?
1. Inventory of Standing Carbon Stocks	An inventory of the Project Area's carbon stocks is required and optional pools has been conducted in accordance with the requirements of the protocol.	6.2.1, Appendix B	Yes
2. Compare Initial Aboveground Standing Live Carbon Stocks with Common Practice	a. Initial aboveground standing live and standing dead carbon stocks have been calculated correctly following the requirements of the protocol. 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 and whether or not the initial carbon stocks fall within the 90% confidence interval of the Common Practice statistic.	6.2.1.2, 6.2.1.3, Appendix B	No
3. Legal constraints and financial viability	a. Effects of legal constraints and financial viability has been appropriated evaluated in accordance with the requirements of the protocol	6.2.1.3, 6.2.1.4,	Yes

Verification Items		Section of FP	Apply Professional Judgment?
4. Description of Forest 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.	2	No

Table 8.1G. Baseline Estimation Verification Items – Improved Forest Management Projects – Public Lands

Verification Items		Section of FP	Apply Professional Judgment?
1. Initial Forest Carbon Stock Inventory	An inventory of the Project Area's carbon stocks in required and optional pools has been conducted in accordance with the requirements of the FP (see Section 8.3.5 for further verification guidance).	6.2.3, Appendix B	Yes
2. Estimating Baseline Carbon Stocks	A COLE report and analysis has been conducted per the requirements in Section 6.2.3 and the Appendix B.	6.2.3, Appendix B	Yes
3. Description of Forest 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.	2	No

Table 8.1H. Baseline Modeling Verification Items – Avoided Conversion Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Initial Forest Carbon Stock Inventory	An inventory of the Project Area's carbon stocks in required and optional pools has been conducted in accordance with the requirements of the FP (see Section 8.3.5 for further verification guidance).	6.3, Appendix B	Yes
2. Baseline Carbon Stock Modeling	a. An alternative highest-value land use for the Project Area has been clearly identified by the required appraisals. b. The rate of conversion and removal of onsite forest carbon stocks has been appropriately estimated in accordance with the requirements of Section 6.3. c. A 100-year forest management simulation of standing live carbon stocks has been conducted per the requirements in Section 6.3, and Appendix B (see Section 8.3.6 for further verification guidance).	3.3.2.3, 6.3	Yes

Verification Items		Section of FP	Apply Professional Judgment?
3. Discount for the Uncertainty of Conversion Probability	The Avoided Conversion Discount factor has been correctly calculated per Equation 6.6 in Section 6.3.	3.3.2.3, 6.3	No
4. Description of Forest 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.	2	No

8.3.1.4 Calculating Baseline Carbon in Harvested Wood Products

Verification bodies are required to confirm that the Project Operator has developed a baseline characterization for carbon in harvested wood products according to the requirements of this protocol and requirements and guidance in Section 6, Section 6.1, Section 6.2.2, Section 6.2.3, or Section 6.3.2, and Appendix B.

Table 8.1I. Baseline Carbon in Wood Products Verification Items – Reforestation Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Baseline Harvest Volume	The average 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 6.1.3 and Appendix B (see Section 8.3.7 for further verification guidance).	6.1.3, Appendix B	No
2. Long-Term Storage in Wood Products	The average amount of carbon expected to be transferred to wood products each year and stored over the long-term (100 years) has been calculated following the requirements and guidance in Appendix B (see Section 8.3.7 for further verification guidance).	Appendix B	No

Table 8.1J. Baseline Carbon in Wood Products Verification Items – Improved Forest Management Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Baseline Harvest Volume	The average 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 6.2.2, or through the appropriate default approach in Section 6.1 or Section 6.2.3, and Appendix B (see Section 8.3.7 for further verification guidance).	6.1, 6.2.2, 6.2.3, Appendix B	No

2. Long-Term Storage in Wood Products	The average amount of carbon expected to be transferred to wood products each year and stored over the long-term (100 years) has been calculated following the requirements and guidance in Appendix B (see Section 8.3.7 for further verification guidance).	Appendix B	No

Table 8.1K. Baseline Carbon in Wood Products Verification Items – Avoided Conversion Projects

Verification Items		Section of FP	Apply Professional Judgment?
1. Baseline Harvest Volume	The volume of harvesting in each year of the baseline over 100 years has been derived from the harvesting regime assumed for the baseline for onsite carbon stocks, following the requirements and guidance in Section 6.3.2, and Appendix B (see Section 8.3.7 for further verification guidance).	6.3.2, Appendix B	No
2. Long-Term Storage in Wood Products	The amount of harvested wood that would be delivered to mills in each year has been determined, and the amount of carbon expected to be transferred to wood products each year and stored over the long-term (100 years) has been calculated following the requirements and guidance of Section 6.3.2 and Appendix B (see Section 8.3.7 for further verification guidance).	6.3.2, Appendix B	No

8.3.2 Site Visit Verification

Site visit verification involves review of the Forest Project's carbon stock inventory estimates, relevant attestations, soil carbon emissions associated with management activities, risk of reversal ratings, and compliance with Natural Forest Management criteria. After a Forest Project's initial verification, subsequent site visits must assess and ensure accuracy in measurement and monitoring techniques and onsite record keeping practices.

Table 8.2. Site Visit Verification Items

Verification Items		Section of FP	Apply Professional Judgment?
1. Attestations	Proof that the project proponent has completed the required attestations in WAC 173-446-520	3.5	Yes

Verification Items		Section of FP	Apply Professional Judgment?
2. Sustainable Harvesting Practices	a. Commercial Rotational Harvesting has not commenced within the Project Area, or b. At the time Commercial Rotational Harvesting is initiated within the Project Area, the Project Operator meets sustainable harvest practices on all of its landholdings, as described in Section 3.4.	3.4	No
3. Change in Project Operator Landholdings	If the Project Operator has acquired additional forestlands outside of the Project Area, the Project Operator must incorporate the newly acquired land in their demonstration of sustainable long-term harvesting practices within 5 years of the acquisition.	3.4	No
4. Maintenance of Standing Live Carbon Pool	No decrease has occurred in the Project Area's standing live carbon stocks over any ten-year consecutive period not accounted for by allowable exceptions.	3.6.3	No
5. Natural Forest Management	Natural Forest Management eligibility criteria in Section 3.6.2 have been and continue to be met (see Section 8.3.4 for further verification guidance).	3.6.2	Yes
6. Estimates of Actual Onsite Carbon Stocks	a. An inventory of the Project Area's carbon stocks in required and optional pools has been conducted in accordance with the requirements in Section 6 and the requirements and guidance in Appendix B (see Section 8.3.5 for further verification guidance), or b. Inventory has been deferred until the second site visit verification for Reforestation Projects.	6, Appendix B	Yes
7. Estimates of Actual Carbon in Harvested Wood Products	The amount of harvested wood that has been delivered to mills over the reporting period has been determined correctly, and the amount of carbon expected to be transferred to wood products and stored over the long-term (100 years) has been calculated correctly, per the requirements in Section 6 and Appendix B (see Section 8.3.7 for further verification guidance).	6, Appendix B	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.	6.1.4, 6.2.6, 6.3.5	No

Verification Items		Section of FP	Apply Professional Judgment?
10. Reversal Determination	If a reversal has occurred, the type of reversal (intentional or unintentional) has been properly identified.	WAC 173-446-570	Yes
11. Reversal Risk Rating	Project's risk rating has been calculated following the requirements of Appendix A	Appendix A	No

8.3.3 Desk Review Verification

For reporting periods in between required site visits, project verification activities may consist of a desk review. During a desk review, the verification body will review the data in annual monitoring reports to check calculations and information for reasonability, accuracy, and completeness.

Table 8.3. Desk Review Verification Items

Verification Items		Section of FP	Apply Professional Judgment?
1. Attestations	Proof that the project proponent has completed the required attestations in WAC 173-446-520	3.5	Yes
2. Maintenance of Standing Live Carbon Pool	No decrease has occurred in the Project Area's standing live carbon stocks over any ten-year consecutive period not accounted for by allowable exceptions.	3.6.3	No
3. Estimates of Actual Onsite Carbon Stocks	Reported onsite carbon stocks are within expected bounds given reported harvest, growth, and disturbance effects since the prior reporting period.	6, Appendix B	Yes
4. Estimates of Actual Carbon in Harvested Wood Products	The reported amount of wood that has been delivered to mills over the reporting period is consistent with reported harvest levels, and the amount of carbon expected to be transferred to wood products and stored over the long-term (100	6, Appendix B	Yes

Verification Items		Section of FP	Apply Professional Judgment?
	years) has been calculated correctly, per the requirements in Section 6 and Appendix B (see Section 8.3.7 for further verification guidance).		
5. Quantification of Primary Effect	Calculations for the Primary Effect are complete and accurate for both onsite carbon stocks and harvested wood products.	6	No
6. Quantification of Secondary Effects	Calculations for quantifying Secondary Effects are complete and accurate.	6.1.4, 6.2.6, 6.3.5	No
7. Reversal Determination	If a reversal has occurred, the type of reversal (intentional or unintentional) has been properly identified.	WAC 173-446-570	Yes
8. Reversal Risk Rating	Reversal risk rating is the same used since the previous site visit verification.	Appendix A	No

8.3.4 Natural Forest Management

All Forest Projects must promote and maintain a diversity of native species and utilize management practices that promote and maintain native forests comprised of multiple ages and mixed native species at multiple landscape scales (Natural Forest Management). At a Forest Project's first site visit verification and at all subsequent site visit verifications, the verification body must evaluate the project against the Natural Forest Management criteria described in Section 3.6.2, referencing the most current Assessment Area Data File available on the Forest Protocol webpage. Forest project carbon stock inventories (requirements for which are contained in Appendix B) should be used as the basis of these assessments where applicable. Forest projects that do not initially meet Natural Forest Management criteria but can demonstrate progress towards meeting these criteria within the required timelines are eligible to register and maintain that registration with Ecology.

Table 8.4. Natural Forest Management Verification Items

Verification Items		Apply Professional Judgment?
1. Native Species	Completed inventory demonstrates that project consists of at least 95% native species. Must demonstrate continuous progress toward goal and criterion must be met within 50 years.	No
2. Composition of Native Species	a. Reforestation Projects: Documentation on planted mixture of species combined with natural regeneration meets composition of native species goals. Project must show continuous progress and criteria must be met within 50 years, unless an exception has been made through a letter from the State Forester as described in Section 3.6.2. b. Improved Forest Management and Avoided Conversion Projects: Completed inventory demonstrates distribution of average basal area of standing live tree species meets composition of native species goal. Project is not eligible unless it is demonstrated that management activities will enable this goal to be achieved over the project life or an	No

Verification Items		Apply Professional Judgment?
	exception has been made through a letter from the State Forester as described in Section 3.6.	
3. Sustainable Harvesting Practices	Documentation showing that the forest, including entity lands outside Project Area, is currently under one of the following: a. Third party certification under the Forest Stewardship Council or Sustainable Forestry Initiative/ Tree Farm System, or b. A renewable long-term management plan sanctioned and monitored by a state or federal agency within a Ecology-approved Assessment Areas, or c. Silvicultural practices that maintain canopy retention averaging at least 40% across the entire forestland owned by the Project Operator in the same Assessment Areas covered by the Project Area, as measured on any 20 acres within the Project Operator's landholdings found in any of these Assessment Areas, including land within and outside of the Project Area (areas impacted by Significant Disturbance may be excluded from this test), or d. Possessing a deeded conservation easement(s) that contain terms that ensure growth equals or exceeds harvest over time. Verifiers should make a reasonable attempt to contact the steward of the conservation easement to confirm compliance.	No
4. Forest Structure	a. If the project employs even-aged management, ensure the retention guidelines have been followed. b. Completed inventory demonstrates the project maintains, or makes progress toward maintaining, no more than 40% of forested acres in ages less than 20 years (on a watershed scale up to 10,000 acres, or the Project Area, whichever is smaller). Project must show continuous progress and this criterion must be met within 25 years.	No
5. Structural Elements (Lying and Standing Dead Wood)	Completed inventory work demonstrates that lying and standing dead wood is retained in sufficient quantities and for sufficient duration depending on whether portions of the Project Area have undergone salvage harvesting.	Yes

8.3.5 Verifying Carbon Inventories

Verification bodies are required to verify 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 quantify GHG reductions and removals against the project baseline over time. Verification of carbon inventories consists of ensuring the Project Operator's sampling methodology conforms to requirements listed in the protocol and that the project's inventory sample plots are within specified tolerances when compared to the verifier's sample plots.

Verification is effectively an audit to infer that the inventory estimate is sound. Verification of the project's onsite stocks must occur at each site verification and focus on ensuring that the project's inventory methodology is technically sound and that the methodology has been correctly implemented.

The project must meet the inventory standards in Table 8.5 prior to the verification body initiating field sampling activities. The verifier will re-measure existing monumented sample plots or install sample plots, consistent with the objectives of a random, risk-based, and efficient approach. In doing so, the verifier may weigh the probability of selecting strata and plots based on various criteria – including carbon stocking, access difficulty, and vegetation heterogeneity.
Verifiers 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 verifier).

8.3.5.1 Sequential Sampling for Verification

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

Verification using the sequential sampling methodology requires the verification body to sample randomly selected successive plots. Sequential approaches have stopping rules rather than fixed sample sizes. Verification 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 verification plots may be collected. This is advisable in cases where random chance may have caused the test to fail and a convergence towards agreement is expected with additional verification samples. For instance, variables like in-growth of small trees or standing dead trees falling over and becoming lying dead wood may cause individual plots to fail the test, but do not necessarily indicate a systematic problem with the project inventory.

Worksheets are provided for use by verifiers to assist in verifying sampled data. Plot data must be entered into the worksheet in the random order in which the plots are selected, although measurements can be taken in an order that is more efficient in the field for logistical reasons. For effective application of the sequential statistics in the field, verifiers should process their data through the worksheets at the end of each sampling day, or when convenient for the verification team, to determine whether that day's effort has resulted in the stopping rule being reached.

Standing live and dead trees will be evaluated using a single sequential sampling workbook, by inputting the sum of these SSRs by plot. For projects sampling and accounting for soil carbon, a separate sequential sampling workbook is to be used to input soil carbon plot data.

To increase efficiency in the verification process, three nested levels of sequential sampling for standing live and dead tree data are processed in the sequential sampling worksheets, based on a single sampling exercise performed by the verifier. 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 verified when the stopping rules for the CO_2e/acre test have been met. Passing the diameter and height tests only improves the overall efficiency of the verification 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 verifier and Project Operator is completed. This test is conducted on a plot by plot basis using estimates of CO_2e/acre. The verifier's estimates of CO_2e/acre are derived by measurements of diameter and height (measured by verifier or using Project Operator'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 verifier and the Project Operator is conducted on a tree by tree basis until sequential sampling stopping rules have been achieved, indicating that the verifier and Project Operator 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, verifiers may stop taking their own diameter measurements and may instead use the diameter data provided for each tree from the Project Operator'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 verifier and the Project Operator until sequential sampling stopping rules have been achieved, indicating that the verifier and Project Operator 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, verifiers may stop taking their own height measurements and may instead use the height data provided for each tree from the Project Operator'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. For the verification of soil carbon, only the worksheet for assessing CO_2e/acre on unpaired plots will be used. Worksheets are found on the Forest Protocol webpage.

Ecology has established a ten percent allowance as an acceptable level of agreement between the verifier and the Project Operator, without adjusting the project estimates for uncertainty.

8.3.5.2 Inventory Estimates

The items in Table 8.5 are evaluations that should be made before the verifier goes to the field and analyzes the plots. If a project opts to utilize the Standardized Inventory Methodology, the methodology need not be assessed beyond correct implementation.

Table 8.5. Inventory Methodology Verification Items

	Verification/Evaluation Standards	Insert a 'Failure to Meet Standard' in any category below where the standards on the left are not met or clearly have not been implemented as described in the inventory methodology
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.	X
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. Verifier 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 that have not experienced a harvest or disturbance that affects carbon stocks by more than 10%, using verifier judgment, within the past 10 years. Evaluation of post-harvest polygons and plots is described in 1.c. Evaluation for consistency shall be conducted through comparison with aerial photos or other remotely sensed data, and/or field observation. During evaluation, a verifier 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 verification 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.	X
1.c	Inventory methodology states how the inventory is updated on an annual basis to reflect growth, harvest, and other disturbances. An event is deemed to be a disturbance, whether natural or the result of human activities, if the event results in an estimated loss of more than 10% of the pre-disturbance carbon stocks in the applicable carbon pools. The methodology includes a process to: ▪ Update the inventory for harvest and other disturbances. The immediate updating of an inventory for disturbances will require that a tree list is assigned to the area disturbed, rather than developing a tree list from field measurements, to represent the area disturbed. This may occur by assigning a vegetation label (stratifying) and compiling the inventory so that the area disturbed obtains a tree list representative of the disturbed condition. For stratified inventories, this may be a solution that lasts many years until the forest vegetation is re-stratified due to changes from forest growth. Immediately updating an inventory	X

	Verification/Evaluation Standards	Insert a 'Failure to Meet Standard' in any category below where the standards on the left are not met or clearly have not been implemented as described in the inventory methodology
	may also occur by assigning a 'best-fit' tree list that represents the stand conditions to the plots that were affected by disturbance. This solution is a shorter term solution since the plots used to estimate the inventory have been affected. During all site visit verifications (following the initial site visit verification in cases where the project start date is the same year as the initial site visit verification), the Project Operator must provide a map(s) that displays areas where disturbance has occurred. For stratified inventories, a pre-disturbance map must display the vegetation stratum prior to the disturbance and a post-disturbance map must display the vegetation stratum following the disturbance. For non-stratified inventories, the disturbance map must display the underlying plots, if any, affected by the disturbance. For stratified inventories, a summary tree list associated with the updated vegetation strata shall be provided. For non-stratified inventories, tree lists shall be provided for each plot affected by disturbance. During site verification, verifiers shall randomly select a minimum of 10% of the vegetation polygons (strata polygons) or plots updated for disturbance and determine if the assigned tree lists do not obviously overestimate the carbon associated with the forest structure remaining after the disturbance. Where plots are updated through assignment of a tree list (instead of assigning a vegetation stratum) following the disturbance, the verifier shall ensure all plots have been updated and the updated tree list is consistent with the forest structure remaining after disturbance. For non-stratified inventories, it is not acceptable for a Project Operator to simply remove disturbed plots from the inventory. The plots must be assigned a tree list to estimate the post-disturbance condition. It is acceptable to remove plots from an inventory that is strata-based upon disturbance that affects the plots. Tree lists resulting from stratification or assignment are determined to be inconsistent if the tree list would result in carbon stocks substantially above what in the verifier's professional judgment would associate with the post-disturbance condition. The determination for consistency can be made through an office review by comparing the assigned tree lists with the disturbance events. A verifier can choose to enhance their review for consistency by visiting disturbed sites in the field. To minimize the risk of inaccuracies to the inventory, no more than 10% of the plots used to characterize the project's inventory can be developed from estimated tree lists without increased scrutiny from verification. The plots assigned an estimated tree list must be appropriately coded in the inventory database so that they can be queried and isolated. Plots assigned with an estimated tree list are not to be used in sequential sampling efforts unless the number of plots with estimated tree lists exceeds 10%, in which case all plots, measured or estimated, must be available for random selection for sequential sampling during verification. ▪ Update the inventory for growth using and approved growth model or a stand table projection, as described in Appendix B.	

Verification/Evaluation Standards		Insert a 'Failure to Meet Standard' in any category below where the standards on the left are not met or clearly have not been implemented as described in the inventory methodology
	The inventory being verified is determined to be current using the update methodology.	
1.d	The inventory methodology has been implemented in a consistent manner since the project's inception. If changes have been made to the inventory methodology, such changes have been discussed and approved in writing by the offset project registry or Ecology	X
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 the protocol. Appropriate use of biomass equations is demonstrated.	X

Each applicable pool/combination of pools must meet the minimum precision threshold of +/- 20 percent at the 90 percent confidence interval. Project Operators can improve the precision of their estimates through additional inventory effort but can only include it in their reporting after the confidence estimate has been verified. Projects must include the uncertainty adjustment associated with their most recent verification effort in their estimate of carbon stocks. The emissions associated with site preparation activities (soil, shrubs, and herbaceous understory) are not subject to the same sequential sampling requirements and shall be verified according to the guidance for estimating site preparation emissions for reforestation projects in Appendix B.

8.3.5.3 Measurement Specifics for Verifiers

Verifiers must use the highest standard to conduct measurements during field measurements. Measurements utilized by verifiers during field inspections shall be consistent with the tolerance standards for measurements identified in Appendix B, with the following exceptions:

1. Verifiers shall measure the heights of all trees according to the height measurement used for the species-specific biomass equation on the Climate Action Reserve's Forest Protocol webpage.
2. The use of regressions to estimate heights is allowable for Forest Operators; verifiers should measure each height for comparisons with Forest Operator's estimates.
3. Tools and methods used for distance measurements for plot boundaries should be accurate within 1"/30'.

4. Tools and methods used for distance measurements for height measurements must be able to obtain an accuracy of 6”/100’.
5. Rules for determining ‘in’/’out’ trees:
    a. All borderline trees should be measured to determine status as an ‘in’ or ‘out’ tree.
    b. Verifiers may encounter trees that are ‘in’ that were not measured by the Project Operator. The cause of the omission(s) may be that the trees were determined to be too small to be included, per sampling methodology criteria, at the time of the Project Operator measurement. Per Appendix B, inventory estimates developed by the Project Operator must include all trees 5 inches DBH and larger.
    c. Additionally, Appendix B permits Project Operators to develop an inventory methodology with varying plot areas that are expanded on a per acre basis depending on the size of the plots and with varying DBH requirements for which trees are included in each plot. In such cases, trees that were determined to be too small to be included in a larger plot by the Project Owner, may have grown and now exceed the minimum threshold for inclusion in the larger plot.
    d. To account for this limited growth, the verifier shall not include trees in the verifier measurements (for sequential sampling purposes) if the tree was omitted by the Forest Owner and the tree diameters, at time of verification audit, are less than 7 inches DBH. Similarly, trees that were included by the Forest Owner in a plot with a certain expansion factor and, at the time of verifier audit, have not exceeded the threshold for being switched to a plot with a different expansion factor by more than 10%, shall continue to be entered in the plot determined by the Project Operator, such that the expansion values are consistent for the Project Operator and the verifier.
        i. This applies a reasonable cushion to Project Operators who apply the sampling methodology correctly, but through no fault of their own would otherwise be penalized due to forest growth changing measurement parameters. It should be noted that the cushion is minimal and will not relieve Project Operators from growth over long periods of time that would exceed these allowances. Hence, Project Operators need to base the re- measurement of the plots on an adequate timeframe to avoid verification problems with their inventory data.
        ii. Any trees that do not meet the criteria of the standards listed above shall be included as part of the verifier’s plot estimate for purposes of sequential sampling.
6. Verifiers shall insert their own determination of species for each tree included in the verifier’s inventory.
7. For defect and decay, verifiers may first consider the inputs of the Forest Owner and determine whether or not they were reasonable. If considered reasonable, the verifier may insert the same classification as the Forest Owner for each tree included in the verifier’s inventory. If, however, not considered reasonable, or not recorded by the Forest Owner, the verifier shall insert their own determination.

8.3.5.4 Verifying a Stratified Inventory

If the Project Operator’s inventory is based on a stratified design, verification shall be based on the measurement error that can be assessed at the stratum level. Individual plots within the strata selected for assessment shall

be selected randomly. The verifier 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. Verifiers 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

8.3.5.5 Verifying a Non-Stratified Inventory

If the project is not stratified for each applicable pool, the verifier 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.

8.3.5.6 Verification Within a Strata

Plots must be independently selected using a random or systematic design.

Table 8.6. Number of Passing Plots in Sequence, as a Function of Project Size

Test	Number of Strata Verified	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

The project passes sequential sampling when the minimum number of passing plots in sequence is achieved (as identified in Table 8.6), or the first passing plot after a minimum of 12 plots (paired) or 30 plots (unpaired) have been measured – whichever is achieved first. There are two possible statistical procedures that can be applied to the stratum-level verifications. 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. An unpaired test shall also be applied for soil resampling since, due to the nature of soil sampling, it is not possible to replicate the exact measurement taken by the Project Operator. The range of acceptable error (***δ*, delta**) is fixed at ten percent for both paired and unpaired tests for tree biomass. Delta is fixed at twenty percent for verification of soil samples.

Paired Plots

The statistical test is based on a comparison of the verifier's measurements of plots within a selected stratum, calculated as CO_2e compared to the Project Operator'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 verification and project plots are equal.

1. Perform verification sampling on at least the minimum number of passing plots required in a sequence from Section 8.3.5.4.

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

   Where,
   n = Number of verification 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 $\bar{\bar{X}}_N \leq K$ then accept H_0, If $\bar{\bar{X}}_N > K$ then reject H_0.

   Where,
   $\bar{\bar{X}}_N =$ 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 verifier 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 verifier plots to the Project Operator 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 verification and stratum averages are equal. The following procedure is appropriate for the unpaired test.

1. Perform verification sampling on at least the minimum number of plots required in a sequence from Section 8.3.5.5. Calculate n as the sum of the number of plots from both the stratum (n_p) and the verification (n_v).

2. Calculate the following:

   $\boldsymbol{T_n = \bar{X}_p - \bar{X}_n}$ *Where,*
   T_n = the difference between the means
   $\bar{X}_p$ = stratum mean
   $\bar{X}_n$ = verification 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,
a = the percentile from a standard normal distribution for one half of alpha; 1.96 for α=0.05
$n = n_p + n_v$
S^2 = sample variance of the verification 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 verifier 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 $\boldsymbol{\alpha}$**=0.05** and $\boldsymbol{\beta}$**=0.80**.

8.3.5.7 Determining if the Stopping Rules Have Been Met

The verifier must determine if the stopping rules have been met for each stratum as soon as is convenient.

The verifier must enter their data into the appropriate spreadsheet based upon use of a paired or unpaired test. It is required that the verifier apply the random order selection in the sampling process. The verifier 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 verifier inputs data into the spreadsheet, the verifier 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 verifier'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 verification is complete based on the stopping rules detailed in Section 8.3.5.1. Passing of the plot height and/or diameter stopping rules is not required to pass the inventory verification; however, as discussed above, verifiers 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 stopping requirements, verifiers may 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.

Finally, in addition to evaluating and verifying adherence to the Project Operator's inventory methodology, the verification body must verify the items in Table 8.7. If the project is using the Standardized Inventory Methodology the verification team need not verify these tools beyond proper implementation.

Table 8.7. Additional Verification Items for Inventory Methodology and Implementation

Verification Items		Apply Professional Judgment?
1. Inventory Update Processes	a. Project Operator's inventory document describes methodology for updating inventory data resulting from growth, harvest, and disturbances. Methodology adheres to acceptable forestry practices* b. Harvest/Disturbance updates in inventory management system are implemented per the specified methodology and are representative of the harvest or disturbance. c. Growth is accounted for using an approved growth model or using a stand table projection, as described in Appendix B.	Yes
2. Biomass Equations and Calculations	a. The carbon tonnes per acre for a representative sample plot, computed using the Project Operator's calculation tools, replicate output computed by the verification body.** b. All conversions and expansions are accurate.	Yes

*A forest biometrician employed by the state in which the project is located, or a consulting forest biometrician may be consulted in the event of a dispute between the verification body and Project Operator. The written opinion of the forest biometrician, submitted to the approved offset project registry and Ecology as part of the verification report, shall be considered the authoritative word.
**The verification body must provide an (idealized) 'verification plot' consisting of all tree species in Project Area with varying heights and diameters existing within the Project Area. The plot need not correspond to an actual plot within the Project Area.

8.3.6 Baseline Estimation

Forest Project baselines include assumptions about forest growth and harvest, as influenced by legal and financial constraints, and assumptions regarding the extent of harvest operations under Business As Usual conditions. These are based on either modeled assumption, or default assumptions, as described in Section 6.

Verification bodies are required to verify the baseline estimate for the project at the initial site visit verification for Improved Forest Management Projects and Avoided Conversion Projects. Reforestation baselines may be verified at the second site visit verification.

All reports that reference carbon stocks must be submitted by the Project Operator with the oversight of a Professional Forester. If the project is located in a jurisdiction without a Professional Forester law or regulation, then Certified Forester credentials managed by the Society of American Foresters (see http://www.certifiedforester.org) are required so that professional standards and project quality are maintained.

Table 8.8. Modeled Baseline Verification Items

(Reforestation Projects, Improved Forest Management Projects using the modeling approach, and Avoided Conversion Projects)

Verification Items		Section of FP	Apply Professional Judgment?
1. Document	A modeling document exists that contains all the verification items in this table.	8	No

Verification Items		Section of FP	Apply Professional Judgment?
2. Qualitative Characterization (Reforestation and Avoided Conversion Projects Only)	A sufficiently detailed qualitative characterization has been included in the modeling document that documents the general assumptions of the project's baseline. The qualitative assessment addresses the vegetative conditions and activities that would have occurred.	6, 6.3	Yes
3. Model Choice and Calibration	a. The model used is an approved model. b. The Project Operator has provided a rationale for any model calibrations or a sufficient explanation of why calibrations were not incorporated. c. The Project Operator has provided a description of the site indexes used for each species and a sufficient explanation of the source of the site index values used.	Appendix B	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, 6.1.1, 6.2.2, 6.3	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. For Improved Forest Management projects, Project Operator has provided either 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.	3.3.2, 6.1.1, 6.2.2, 6.3	Yes
6. Silviculture Guidelines	The silviculture guidelines incorporated in the model demonstrate all legal constraints are applied in the model. The silviculture guidelines must include: i. A description of the trees retained by species group ii. The level of retention iii. Harvest frequency iv. Regeneration assumptions	Appendix B	No
7. Modeling Guidelines	a. Reforestation: Modeling is based on the qualitative characterization of the baseline and conducted per Section 6. b. Improved Forest Management: Modeling is conducted per Section 6.2. c. Avoided Conversion: Modeling is conducted per Section 6.3.	6, 6.2, 6.3	No
8. Modeling Outputs	a. The Project Operator has provided reports that display periodic harvest, inventory, and growth estimates for the entire Project Area 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 B	Yes

Table 8.9. Default Baseline Verification Items

(Improved Forest Management projects using the conservative default approach, and Improved Forest Management projects on public lands)

Verification Items		Section of FP	Apply Professional Judgment?
1. Document	The Offset Project Data Reportexplains the baseline quantification steps undertaken.	8	No
2. Default Approach	a. The project is eligible to use the conservative default approach and has followed the steps to establish a default baseline in Section 6.1 b. The project has correctly run the COLE report as described in Section 6.2.3	6.1, 6.2.3, Appendix B	No
4. Legal Constraints	The project has correctly accounted for baseline legal constraints	6.1, 6.2.3	Yes
5. Incorporating Other Carbon Stocks	The final baseline has been adjusted to account for all required SSRs	6.1, 6.2.3, Appendix B	No

8.3.7 Verifying Estimates of Carbon in Harvested Wood Products

Verification bodies are required to verify the estimates of carbon that are likely to remain stored in wood products over a 100-year period, as submitted in the Offset Project Data Report (for baseline estimates) and annual monitoring reports (for actual wood product production).

Accounting for wood product carbon must be applied only to actual or baseline volumes of wood harvested from within the Project Area. Trees harvested outside of the Project Area are not part of the Forest Project and must be excluded from any calculations.

Table 8.10. Carbon in Harvested Wood Products Verification Items

Verification Items		Section of FP	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 B	No
2. Account for Mill Efficiencies	The correct mill efficiency factors have been used to calculate total carbon transferred into wood products.	Appendix B	No

Verification Items		Section of FP	Apply Professional Judgment?
3. Wood Product Classification	The percentages of harvest by wood product class has been determined correctly with verified 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 B	No
4. Calculation of In-Use and Landfill Carbon Storage	a. The average amount of carbon stored in in-use wood products over 100 years has been calculated correctly using the worksheets referenced in Appendix B. b. The average amount of carbon stored in landfilled wood products over 100 years has been calculated correctly using the worksheets referenced in Appendix B.	Appendix B	No
5. Total Average Carbon Storage in Wood Products Over 100 Years	Total average carbon storage in wood products over 100 years for a given harvest volume has been calculated and reported.	Appendix B	No

8.3.8 Verifying Calculations of Reversal Risk Ratings and Contributions to the Buffer Pool

At each site visit verification, Project Operators must derive a reversal risk rating for their Forest Project using the worksheets in Appendix A. The worksheets are designed to identify and quantify the specific types of risks that may lead to a reversal, based on project-specific factors.

Table 8.11. Reversal Risk Rating Verification Items

Verification Items		Section of FP	Apply Professional Judgment?
1. Financial Risk	Use of a Qualified Conservation Easement or Qualified Deed Restriction, occurrence on public lands, or use of a PIA alone.	Appendix A.1	No
2. Management Risk	a. Management Risk I – Illegal removals of forest biomass. b. Management Risk II – Conversion of Project Area to alternative land uses. c. Management Risk III – Over-harvesting.	Appendix A.2	No
3. Social Risk	Social Risk.	Appendix A.3	No
4. Natural Disturbance Risk	a. Natural Disturbance Risk I – Wildfire, Disease or insect outbreak. c. Natural Disturbance Risk II – Other episodic catastrophic events.	Appendix A.4	Yes

Verification Items		Section of FP	Apply Professional Judgment?
5. Completing the Risk Rating Analysis	Reversal risk rating calculated correctly using the formula in Appendix A.5.	Appendix A.5	No

8.4 Completing the Verification Process

After completing the core project verification activities for a Forest Project, the verification body must do the following to complete the verification process:

1. Complete a detailed List of Findings containing both immaterial and material findings (if any) and deliver it to the Project Operator (private document).
2. Exchange correspondence as necessary to resolve issues detailed in the List of Findings, until all material misstatements and nonconformances have been addressed.
3. If a reasonable level of assurance opinion is successfully obtained, complete a Verification Report to be delivered to the Project Operator (public document).
4. Complete the Verification Statement form, detailing the vintage and the number of GHG reductions and removals verified and deliver it to the Project Operator (public document).
5. Verify that the number of GHG reductions and removals, as well as the reversal risk rating, specified in the Verification Report and Statement match the number in the Offset Project Data Report.
6. Conduct an exit meeting with the Project Operator to discuss the Verification Report, List of Findings, and Verification Statement.
7. Upload electronic copies of the Verification Report, List of Findings, Verification Statement, and Verification Activity Log to the approved offset project registry.

Appendix A Determination of a Forest Project's Reversal Risk Rating

Project Operators must derive a reversal risk rating for their Forest Project using the worksheets in this section. The worksheets are designed to identify and quantify the specific types of risks that may lead to a reversal, based on project-specific factors.

This risk assessment must be updated every time the project undergoes a verification site visit. Therefore, a project's risk profile and its assessment are dynamic. Furthermore, estimated risk values and associated mitigation measures may be updated periodically by the Ecology as improvements in quantifying risks or changes in risks are determined. Any adjustments to the risk ratings will affect only current and future year contributions to the Buffer Pool.

Risks that may lead to reversals are classified into the categories identified in Table A.1.

Table A.1. Forest Project Risk Types

Risk Category	Risk Type	Description	How Risk is Managed in this Protocol
Financial	Financial Failure Leading to Bankruptcy	Financial failure can lead to bankruptcy and/or alternative management decisions to generate income that result in reversals through over-harvesting or conversion	Default Risk
Management	Illegal Harvesting	Loss of project stocks due to timber theft	Default by Area
	Conversion to Non-Forest Uses	Alternative land uses are exercised at project carbon expense	Default Risk
	Over-Harvesting	Exercising timber value at expense of project carbon	Default Risk
Social	Social Risks	Changing government policies, regulations, and general economic conditions	Default Risk

Risk Category	Risk Type	Description	How Risk is Managed in this Protocol
Natural Disturbance	Wildfire	Loss of project carbon through wildfire	Project-specific Risk
	Disease/Insects	Loss of project carbon through disease and/or insects	
	Other Episodic Catastrophic Events	Loss of project carbon from wind, snow and ice, or flooding events	

A.1 Financial Risk

Financial failure of an organization resulting in bankruptcy can lead to dissolution of agreements and forest management activities to recover losses that result in reversals. Projects that employ a Qualified Conservation Easement or Qualified Deed Restriction, or that occur on public or Tribal lands are at a lower risk

Table A.2. Financial Failure Leading to Bankruptcy

Applies to all projects		
Identification of Risk	**Contribution to Reversal Risk Rating**	
Default Financial Risk	Forest project without a qualified conservation easement and not on public or tribal lands	Forest project with a qualified conservation easement, or on public or tribal lands
	5%	1%

A.2 Management Risk

Management failure is the risk of management activities that directly or indirectly could lead to a reversal. Projects that employ a conservation easement or deed restriction, or that occur on public lands, are exempt from this risk category.

[42] For the purposes of this protocol, “tribal lands” includes tribal land, land owned by Alaska Native Corporations, and Hawaiian home land.

Management Risk I – Illegal Removals of Forest Biomass

Illegal logging occurs when biomass is removed either by trespass or outside of a planned set of management activities that are controlled by regulation. Illegal logging is exacerbated by lack of controls and enforcement activities.

Table A.4. Risk of Illegal Removals of Forest Biomass

Applies to all projects	
Identification of Risk	**Contribution to Reversal Risk Rating**
United States Default Harvesting Risk	0%

Management Risk II – Conversion of Project Area to Alternative Land Uses

High values for development of housing and/or agriculture may compete with timber and carbon values and lead to a change in land use that affects carbon stocks. The risk of conversion of any Project Area to other non-forest uses is related to the probability of alternative uses, which are affected by many variables, including population growth, topography, proximity to provisions and metropolitan areas, availability of water and power, and quality of access to the Project Area.

Table A.5. Risk of Conversion to Alternative Land Use

Applies to all projects	
Identification of Risk	**Contribution to Reversal Risk Rating**
With Qualified Conservation Easement or Qualified Deed Restriction that explicitly encumbers all development rights or on public or tribal lands	0%
Without Qualified Conservation Easement or Qualified Deed Restriction	2%

Management Risk III – Over-Harvesting

Favorable timber values, among other reasons, may motivate some project managers to realize timber values at the expense of managing carbon stocks for which Ecology Offsets have been credited.
Additionally, reversals can occur as the result of harvest associated with fuels treatments.

Table A.6. Risk of Over-Harvesting

Applies to all projects	
Identification of Risk	**Contribution to Reversal Risk Rating**
With Qualified Conservation Easement or Qualified Deed Restriction that explicitly encumbers timber harvesting associated with project stocks or on public or tribal lands	0%
Without Qualified Conservation Easement or Qualified Deed Restriction	2%

A.3 Social Risk

Social risks exist due to changing government policies, regulations, and general economic conditions. The risks of social or political actions leading to reversals are low but could be significant.

Table A.7. Social Risk Identification

Applies to all projects	
Identification of Risk	**Contribution to Reversal Risk Rating**
United States Default Social Risk	2%

A.4 Natural Disturbance Risk

Natural disturbances can pose a significant risk to the permanency GHG reductions and removals. Natural disturbance risks are only partially controllable by management activities. Management activities that improve resiliency to wildfire, insects, and disease can reduce these risks. Management activities that shift harvesting practices from live sequestering trees to trees that have succumbed to natural disturbances reduce or negate the reversal depending on the size and location of the disturbance.

Natural Disturbance Risk I – Wildfire, Disease, or Insect Outbreak

Wildfire, disease, or insect outbreak have the potential to cause significant reversals, especially in certain carbon pools. These risks can be reduced by certain techniques including reducing surface fuel loads, removing ladder fuels, adding fuel breaks, and reducing stand density.

However, these techniques cannot reduce emission risk to zero because all landowners will not undertake fuel treatments, nor can they prevent wildfire from occurring. Strategies implemented to reduce fuel loads can also improve resiliency to disease or insect outbreak.

Table A.8. Natural Disturbance Risk I – Wildfire, Disease, or Insect Outbreak

Applies to all projects	
Identification of Risk	**Contribution to Reversal Risk Rating**
Refer to the Program provided dataset for the project's Natural Disturbance risk rating	*X*%
If vegetation management treatments have been implemented for the Project Area, reduce the value above by the appropriate percent as indicated below.	*X*% **x** *Y*%

Vegetation treatments must be available in a report and aligned with a comprehensive vegetation management plan that identifies specific temporal and spatial actions to enhance forest resilience across the Project Area. The vegetation management plan must be approved by a state agency or, if approval by a state agency is not possible, developed under the oversight of a Professional Forester and reviewed by Ecology and the approved offset project registry. Verifiers must confirm the status of implementation of the management plan.

Table A.9. Vegetation Management Treatments (Y)

Description of Status of Vegetation Management	Y
Approved vegetation management plan exists, and the plan is being implemented across at least 80% of the intended implementation area detailed in the plan	20%
Approved vegetation management plan exists, and the plan is being implemented across at least 50% of the intended implementation area detailed in the plan	70%
Approved vegetation management plan does not exist, or the plan has not yet been implemented across at least 50% of the intended implementation area detailed in the plan	100%

Natural Disturbance Risk II – Other Episodic Catastrophic Events

A major wind-throw event (hurricane, tornado, high wind event) has the potential to cause a reversal, especially in certain carbon pools.

Table A.10. Natural Disturbance Risk III – Other Episodic Catastrophic Events

Applies to all projects	
Identification of Risk	**Contribution to Reversal Risk Rating**
Default Risk Contribution from Other Catastrophic Events	3%

A.5 Summarizing the Risk Analysis and Contribution to Buffer Pool

Use the table below to summarize the Forest Project's reversal risk rating. As indicated above, projects that employ a conservation easement or deed restriction, or that occur on public or tribal lands, are exempt from certain risk categories. Such Qualified Conservation Easements and Qualified Deed Restrictions must clearly identify the goals and objectives of the Forest Project according to the terms of this protocol.

Table A.11. Project Contribution to the Buffer Pool Based on Risk

Risk Category	Contribution from Risk Descriptions Above		
	Source	Private Lands	Qualified Conservation Easement and/or a Qualified Deed Restriction and/or Public or Tribal Ownership
Financial Failure[43]	Default Risk	5%	1%
Illegal Forest Biomass Removal	Default Risk	0%	0%
Conversion	Default Risk	2%	0%

	Contribution from Risk Descriptions Above

Risk Category	Source	Private lands	Qualified Conservation Easement and/or a Qualified Deed Restriction and/or Public or Tribal Ownership
Over-Harvesting	Default Risk	2%	0%
Social	Default Risk	2%	2%
Wildfire, Disease, or Insect Outbreak	Calculated Risk from Table A.8	*X*% or (*X*% x *Y*%)	*X*% or (*X*% x *Y*%)
Other Catastrophic Events	Default Risk	3%	3%

Completing the Risk Rating Analysis

The project's reversal risk rating is calculated as follows:

$$100\% - ((1 - FinancialFailure\%) \times (1 - IllegalForestBiomassRemoval\%) \times (1 - Conversion\%) \times (1 - OverHarvesting\%) \times (1 - SocialRisk\%) \times (1 - Wildfire\%) \times (1 - Disease/InsectOutbreak\%) \times (1 - OtherCatastrophicEvents\%))$$

Appendix B Quantification Guidance for Use with Forest Carbon Projects

This appendix provides guidance for quantifying a forest project's onsite carbon stocks and carbon in harvested wood products, both for purposes of estimating a project's baseline as well as providing ongoing estimates of onsite project carbon stocks throughout the project life.

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B.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
B.1 displays the reporting requirements for each of the carbon pools.

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

Category	Carbon Pool	Improved Forest Management	Avoided Conversion
Living Biomass	Live Trees	Required for project reporting	
	Shrubs and Herbaceous Understory	Not allowed for project reporting	
Onsite Dead Biomass	Standing Dead Trees	Required for adherence to Natural Forest Management criteria	
		Required for project reporting	
	Lying Dead Wood	Required for adherence to Natural Forest Management criteria	
		Not allowed for project reporting	
	Litter	Not allowed for project reporting	
Soil	Soil	Required for emissions reporting associated with management activities, if applicable	
		Not allowed for reporting of project benefits	Optional for reporting of project benefits in Avoided Conversion projects only
Offsite Dead Biomass	Harvested Wood Products	Required for project reporting	

B.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 B.1. Project Operators must include an inventory methodology in the documents submitted to the offset project registry. The inventory methodology must include the required provisions identified in this section.

B.3 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 verification purposes. Plot monument strategies that incorporate Global Positioning Systems (GPS) along with additional navigational strategies at close range to plot centers (that direct verifiers to the precise plot location) that are resistant to weather, wildlife, and other environmental factors, can substantially reduce verification costs. Project Operators are advised to consider the verification guidance (Section 10 of the Forest Protocol) associated with verification of sampled carbon pools (in particular, the sequential sampling guidance) prior to settling on a strategy to monument plot locations.

B.4 Updating Forest Inventories

Forest inventories are always in flux due to forest growth, harvest, and natural disturbances. Therefore, inventories of carbon pools must either be updated or re-measured at a frequency commensurate with the anticipated or actual changes in the specific carbon pools so that sample plots and forest stratification reflect current conditions. Project Operators must report their estimated carbon stocks on an annual basis. Since it is infeasible to immediately re- measure all plots following forest growth and disturbances that affect plot measurements, acceptable strategies for updating project inventory estimates are described in this section.

B.5 Updating for Forest Growth

Updating plot data for forest growth can be accomplished through the use of growth models or stand table projections that mimic the diameter and height increment of trees in the inventory database. Any plot data that are updated to reflect current conditions with the use of predicted increments of height and diameter data will be used during site visit verifications to compare against verifier's field measurements using the sequential sampling techniques described in the verification section of the Forest Protocol. This provision ensures that plot measurements and update processes are within accuracy thresholds.

Plot data reported should always coincide with the end of the reporting period. If plot data was taken before the end of the reporting period, it should be grown forward to coincide with the end date. Similarly, if plot data was taken after the end of the reporting period, it should be degrown to the end date. The Project Operator may determine a reasonable method for apportioning growth to the reporting period end date, and should employ the same method whenever new inventory measurements are taken.

B.6 Updating for Disturbances (Including Harvest)

Inventory estimates must be updated annually for any disturbance (including harvest disturbance) that results in an estimated reduction to the reported carbon pools of 0.5 percent or more. However, given that it may be infeasible to re-measure all plots following a disturbance, up to 5 percent of the total inventory plots used to derive the inventory estimate can be excluded at any one time. Only plots in disturbed areas may be excluded, and no plot can be excluded for a period of time greater than one reporting period. Thus, excluded plots

must be remeasured for inclusion in the inventory for the Reporting Period immediately following the Reporting Period during which the disturbance occurred. Plots that are geographically situated in areas that experienced forest cover class-changing harvests and/or natural disturbances in the previous year must be excluded from the inventory analysis until the plots are updated with re-measured data from field visits, subject to the 5 percent limit on excluded plots outlined above.

If the inventory is stratified, the area that has been disturbed can simply be re-stratified with a stratum that reflects the post-disturbance forest condition, following the stratification rules developed for the project. Any plots that existed in the disturbed area must be removed from the set of plots used to estimate the stratum average unless, and until, the affected plots are re- measured. Verification of stratified inventories must ensure that the area disturbed is accurately characterized in the inventory GIS system and that the assigned stratum reflects the forest condition.

For non-stratified inventories, an estimated tree list that represents the post-disturbance condition of the forest must be assigned to any plots affected by the disturbance. The tree list must be carefully selected to not overstate the carbon pools present. Site verification of post- disturbance plots will evaluate whether the tree list assigned is appropriate for the post- disturbance condition. No more than 10 percent of the project's area may be represented through estimated plots without increased verification scrutiny during a site visit. Specifically, where more than 10 percent of the project's area is based on estimated tree lists assigned to plots, verification using sequential sampling techniques shall include all plots (including estimated plots) in the sequential sampling comparison between Project Operator estimates and verifier estimates.

Plots that are estimated shall not be used in the calculations for sampling error. Estimates from sampled pools must meet a minimum confidence standard of +/- 20 percent at the 90 percent confidence interval. It is acceptable to calculate the descriptive statistics, including confidence intervals, using plot data that have been updated to a current date. Discounts for uncertainty are applied to project estimates when confidence standards are below +/- 5 percent at the 90 percent confidence interval. This is described in greater detail below.

B.7 Requirements for Estimating Carbon in Standing Live and Dead Trees

It is required that both standing live and standing dead trees be sampled. It is acceptable, but not required, to combine standing live and dead trees during sampling such that descriptive statistics, including confidence statistics, address the combined pools. Whether combined or not, tree data must be coded so that mean estimates can be interpreted independently for standing live and standing dead pools to allow monitoring of standing dead trees with respect to requirements in the Natural Forest Management section (Section 3.6) of the Forest Protocol.

Inventory methodologies must include a description of how the sampled data will be archived 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 verification 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 B.2 displays the requirements that all project inventory methodologies must include for standing live and dead trees.

Table B.2. Requirements for Sampling Standing Live and Standing Dead 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, down to as low as 1 inch DBH, as long as the applicable allometric equation is appropriate for such sizes. 2. The location of the measurement of DBH must follow U.S. FIA sampling guidelines 3. Measurement precision must be no greater than the nearest inch.
Height	1. Inventory methodologies 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. The sampling precision for tree heights (when measured) must be stated in the inventory methodology. Stated acceptable precision for measured heights not to be greater than +/- 10 feet. 4. 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. The process for updating forest strata must be described. 4. Where inventories are stratified, stratum areas must be provided at verification with maps and tabular outputs.
Status	1. Each sampled tree must be identified as live or dead. 2. Dead trees must be coded with the decay status so density adjustments can be made. Decay class descriptions and density adjustments are provided below.
Biomass Equations	1. All projects must calculate the biomass in each tree using the biomass equations adopted by Ecology (can be found on the Climate Action Reserve's Forest Protocol webpage). 2. The project's inventory methodology must include a list of the equations and cite the version of the Climate Action Reserve's equation file from which they were copied.
Deductions for Missing Biomass	1. Both live and dead 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. Alternative methods that address deductions for missing biomass are subject to approval by the Ecology.

Sampling methodologies and measurement standards should be consistent throughout the duration of the forest project. If new sampling methodologies are incorporated during the project life, they must be approved by Ecology and the approved offset project registry.

Sampling methodologies and measurement standards will be evaluated for their statistical validity. Additionally, uncertainties in estimates associated with modifications to sampling methodologies may require reconciliation to project data and/or baseline estimates and shall be conducted at Ecology's discretion. The application of a revised sampling methodology can only occur as part of a site visit verification.

B.8 Use of Regression Equations

It is acceptable to develop carbon inventories using regression estimators to estimate tree heights. Project Operators must keep in mind that plots or (sub) populations will be randomly selected for verification 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 verification.

B.9 Forest Vegetation Stratification

Stratification is not required, but it may simplify verification and possibly lower the costs of verification. 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 offset project data report. The methodology must also include the process guidelines for updating forest strata for disturbance and growth events.

B.10 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 Action Reserve's Forest Protocol webpage. 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 for Improved Forest Management projects.

Equation B.1. California, Oregon, Washington (Temperate Equation)

$$BBD = exp[-0.7747 + 0.8836 \times ln(ABD)]$$

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

Equation B.2. Alaska (Boreal Equation)

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 B.3. Hawaii (Tropical Equation)

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.

B.11 Adjustments to Standing Live and Standing Dead Trees for Missing Volume and Decay

Both standing dead trees and 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. Calculating CO_2e in standing dead trees raises additional challenges since they may be in stages of decay such that density equations in standard biomass equations for live trees do not provide an accurate estimate. The guidance in this section provides a standardized method to account for 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 Action Reserve's Forest Protocol webpage. The tree's biomass is then adjusted based on the tree's 'net' biomass and adjusted density estimates for standing dead trees. 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 below-ground portion. The below- ground portion must be calculated as it would for a normal, healthy tree, using the Cairn's equation where the regional biomass equations are used instead of the CRM. It is assumed that the below-ground portion is intact and complete. The standardized percentages assumed to be in each portion of the tree are shown in Table B.3.

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

Tree Portion	Percent of 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.

The tree's density must be adjusted to account for the varying states of decay in the remaining portion of the tree. Because standing dead wood does not have the same density as a live tree, a density reduction must be applied. Standing dead wood may fall into five decay classes, which must be recorded during the field sampling. The five decay classes, described in Table B.4, are qualitative, based on the physical characteristics of the dead tree (USDA 2007, Woundenberg et al., 2010).

Table B.4. Decay Classes

Decay Class	Description of Condition of Standing Dead Wood
1	All limbs and branches are present; the top of the crown is still present; all bark remains; sapwood is intact with minimal decay; heartwood is sound and hard.
2	There are few limbs and no fine branches; the top may be broken; a variable amount of bark remains; sapwood is sloughing with advanced decay; heartwood is sound at base but beginning to decay in the outer part of the upper bole.
3	Only limb stubs exist; the top is broken; a variable amount of bark remains; sapwood is sloughing; heartwood has advanced decay in upper bole and is beginning at the base.
4	Few or no limb stubs remain; the top is broken; a variable amount of bark remains; sapwood is sloughing; heartwood has advanced decay at the base and is sloughing in the upper bole.
5	No evidence of branches remains; the top is broken; less than 20 percent of the bark remains; sapwood is gone; heartwood is sloughing throughout.

The density identified for each species in the biomass equations posted on the Climate Action Reserve's Forest Protocol webpage must be modified for decay classes 2 to 5 using the reduction factors displayed in Table B.5,[44] which are multiplied by the densities provided in the biomass equations.

Table B.5. Average Density Reduction Factors for Standing Dead Wood for Hardwoods and Softwoods by Decay Class

Softwoods		Hardwoods	
Decay Class	**Reduction Factor**	**Decay Class**	**Reduction Factor**
2	1.0	2	0.8
3	0.92	3	0.54
4	0.55	4	0.43
5	0.29	5	0.22

[44] Harmon et al. (2011). Differences between standing and downed dead tree wood density reduction factors: A comparison across decay classes and tree species. Res. Pap. NRS-15. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 40 p.

An example of field data that has all of the required elements for calculating the standing dead tree's CO_2e is shown in Table B.6.

Table B.6. Example: Data Attributes Needed to Calculate CO_2e in Standing Dead Trees

Tree Number	Species (type)	Status	DBH (inches)	Height* (feet)	Percent Remaining			Decay Class
					Top 1/3 of Tree	Middle 1/3 of Tree	Bottom 1/3 of Tree	
1	Hardwood	Dead	16	95	0%	50%	100%	3

*Estimated height prior to death

The density of the tree must be adjusted based on its decay class. The first step is to calculate the tree's biomass as if the tree were a normal tree to determine the tree's gross biomass. Net biomass is determined by multiplying the gross biomass of the tree by the reduction factor displayed in Table B.5. An example is provided in Table B.7.

Table B.7. Example: Adjusting Biomass Calculation for Decay Using Density Adjustment Factors

Tree Gross Biomass	Density Reduction Based on Decay	Net Biomass
(tonnes CO_2e) (Assumed)	(from Table B.5 for a hardwood with a decay class '3')	(tonnes CO_2e) (Assuming tree is whole)
0.100	0.54	0.054

As an example of the application of the biomass deductions for missing sections of the tree, using the data from Table B.6 above, a tree (assuming normal form) with a net biomass of 0.054 CO_2e tonnes would be further adjusted to a net biomass for the missing portions of the tree as shown in Table B.8.

Table B.8. Example: Calculating Net Biomass in a Tree

Tree Portion	Percent of Tree Biomass	Gross Biomass	Percent Remaining in Tree	Net Biomass
	(from Table B.)	(tonnes CO_2e) Percent of tree biomass **x** tree biomass adjusted for density (Table B.7)	(from example in Table B.6)	(tonnes CO_2e) Percent remaining in tree **x** gross biomass
Top 1/3	10%	10% **x** 0.054 **=** 0.0054	0%	0.00000
Middle 1/3	30%	30% **x** 0.054 **=** 0.0162	50%	0.0081
Bottom 1/3	60%	60% **x** 0.054 **=** 0.0324	100%	0.0324
Total Biomass			200	0.0405

B.12 Requirements for Estimating Lying Dead Wood Carbon

All projects must either maintain an inventory of lying dead wood for the project area or monitor harvested areas according to the guidance in this section to ensure the project meets the conditions identified in Section 3.6.2 (Natural Forest Management) of the Forest Protocol. Lying dead wood is not eligible for crediting due to the high variability associated with estimating lying dead wood, resulting in estimates with unacceptable levels of uncertainty for crediting. Project Operators are required to include the status of lying dead wood with each monitoring report.

Project Operators that choose to meet the monitoring requirement by maintaining an inventory of lying dead wood must meet the following requirements:

1. Inventory plots or transects used to provide the lying dead wood estimate must be no older than 12 years.
2. Data collected for lying dead wood must include the estimated species, adequate data to estimate volume, and decay class, as defined by Table B.9 below, to estimate the density of the piece of lying dead wood to determine biomass.
3. The sampling methodology must be included in the documents submitted to the offset project registry. The protocol is not prescriptive with regards to the sampling design, other than adhering to general statistical principles of randomness. Fixed area plots and line transects, among other sampling methodologies, are acceptable.
4. The inventory sampling confidence in the estimate of lying dead wood must be at +/- 30 percent at 1 standard error.

Project Operators that choose to meet the monitoring requirement through monitoring of harvested areas must meet the following requirements:

1. A harvested area is any area where commercial removal of forest vegetation has occurred.
2. A map of all areas harvested during the last reporting period must be submitted with the annual monitoring report and must include the harvest date.
3. All harvested areas must be monitored within one year of the harvest date.
4. Fixed area strips shall be randomly located on compass bearings chosen by the Project Operator (but maintained consistent within each harvest area). A recommended width of the fixed area strip is 66 feet (1 chain), which will require monitoring in each of the 33- foot areas on either side of the center line. Ten square chains equals one acre. Project Operators can determine the width of the strip that best suits the vegetation conditions present in the harvested area.
5. A map shall be produced that displays the location of the fixed area strips on the harvested areas. The width of the strip shall be documented for each strip.
6. The minimum area monitored shall be 5 percent of each harvested area.
7. Data collected within the fixed area strip must include the estimated length of the piece of lying dead wood, the average diameter of the lying dead wood, the estimated species, and the decay class as defined by Table B.9 below.

Lying dead wood density must be adjusted to account for the state of decay. Because lying dead wood does not have the same density as a live tree, a density reduction must be applied. Lying dead wood may fall into five decay classes, which must be recorded during the field sampling. The five decay classes are qualitative based on the physical characteristics of the dead tree (USDA 2007, Woundenberg et al., 2010).

Table B.9. Decay Class Descriptions of Lying Dead Wood

Decay Class	Description of Condition of Lying Dead Wood
1	Sound, freshly fallen, intact logs with no rot; no conks present indicating a lack of decay; original color of wood; no invading roots; fine twigs attached with tight bark.
2	Sound log sapwood partly soft but cannot be pulled apart by hand; original color of wood; no invading roots; many fine twigs are gone and remaining fine twigs have peeling bark.
3	Heartwood is still sound with piece supporting its own weight; sapwood can be pulled apart by hand or is missing; wood color is reddish-brown or original color; roots may be invading sapwood; only branch stubs are remaining which cannot be pulled out of log.
4	Heartwood is rotten with piece unable to support own weight; rotten portions of piece are soft and/or blocky in appearance; a metal pin can be pushed into heartwood; wood color is reddish or light brown; invading roots may be found throughout the log; branch stubs can be pulled out.
5	There is no remaining structural integrity to the piece with a lack of circular shape as rot spreads out across ground; rotten texture is soft and can become powder when dry; wood color is red-brown to dark brown; invading roots are present throughout; branch stubs and pitch pockets have usually rotten down.

The density identified for each species in the biomass equations posted on the Climate Action Reserve's website must be modified for decay classes 2 to 5 using the reduction factors displayed in Table B.10,[45] which are multiplied by the densities provided in the biomass equations.

Table B.10. Average Density Reduction Factors for Lying Dead Wood for Hardwoods and Softwoods by Decay Class

Softwoods		Hardwoods	
Decay Class	**Reduction Factor**	**Decay Class**	**Reduction Factor**
2	0.87	2	0.74
3	0.70	3	0.51
4	0.40	4	0.29
5	0.29	5	0.22

An adjusted density coefficient for the downed logs is calculated by multiplying the density coefficient provided with the biomass equations on the Climate Action Reserve's Forest Protocol webpage by the reduction value in the table above. The adjusted density value is multiplied by the volume estimate in the lying dead wood to determine the biomass.

[45] Harmon et al. (2011). Differences between standing and downed dead tree wood density reduction factors: A comparison across decay classes and tree species. Res. Pap. NRS-15. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 40 p.

B.13 Requirements for Estimating Soil Carbon Emissions

All projects must estimate the soil carbon emissions associated with project management practices. This section provides guidance for estimating soil CO_2e within the project boundaries, and quantifying emissions associated with project activities.

No direct sampling of soil carbon is required for projects that are reporting soil carbon emissions only as part of project management practices. Rather, the estimate of emissions is based on soil carbon estimates from United States Geological Survey (USGS) data for project sites and comparing the data to standardized guidance to assess emissions based on management activities.

To summarize, Table B.11 provides the two different approaches to quantifying soil carbon benefits and/or emissions.

Table B.11. Soil Carbon Quantification Methods by Project Type

Project Description	Project Type Identification	Method to Estimate Project Soil Carbon (CO_2e) Stocks	Method to Estimate Project Effects on Soil Carbon (CO_2e)
Project will provide benefits by avoiding soil carbon emissions associated with conversion to agriculture and, in certain cases, residential or commercial (Avoided Conversion)	1	Soil carbon sampling required at project initiation	Initial avoided conversion effects estimated through standardized guidance
			Follow guidance in Step 7
		Follow guidance in Steps 1, 4, 5, and 6	
			Follow guidance in Steps 1, 4, 5, and 6
Project is reporting management-related emissions	2	Use of USGS data	Project effects estimated through default estimates of soil carbon emissions
		Follow guidance in Steps 1, 2, 3, and 6	Follow guidance in Step 7

B.14 Developing an Estimate of Soil CO_2e within the Project Boundaries

Step 1: Identify Soil Orders Present Within Project (**Project Types 1 and 2**)

Project Operators must determine the soil orders present in their project area and the area each soil order represents. Where Natural Resource Conservation Service (NRCS) soil data is available on the NRCS website (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx), projects must use this data. Where NRCS data is either unavailable or believed to be in error at the project site, Project Operators may present the soil orders and area represented by each order with an official letter from a local NRCS representative stating that the portrayal of the soil orders by the Project Operator is accurate. The letter must state why existing data is either absent on the NRCS website or why the data is not accurate.

On the NRCS website mentioned above, users must create an Area of Interest (AOI), using the website tools, that approximates the project boundaries. To determine the soil order, users select the soil reports tab, select land classifications, and select "Taxonomic Classification of Soils". This report provides a taxonomic classification of each of the soils in the AOI. The last four letters of the soil descriptions correspond to the soil order. For example, a soil classified as Xerochrepts is in the Inceptisol order. Table B.12 below displays the soil orders associated with the last four letters in the soil descriptions.

Table B.12. Soil Orders

Soil Order	Last Four Letters in Soil Description
Alfisol	-alfs
Andisol	-ands
Inceptisol	-epts
Mollisol	-olls
Spodosol	-ods
Ultisol	-ults
Histosol	-ists

Step 2: Obtain Soil Organic Matter Values (**Project Type 2**)

Select the tab entitled 'Soil Properties and Qualities', then select 'Soil Organic Matter' and within the advanced options, select 'Weighted Average'. For the aggregation method, select 'Higher' as the tie break rule, and designate '0-30 cm' for the soil depth. Next, click 'View Ratings' to review the organic matter percentage for each soil type in the AOI. Convert the number from the rating to decimal percent by dividing by 100.

Step 3: Obtain the Soil Bulk Density Values (**Project Type 2**)

Soil bulk density estimates are determined by first selecting the 'Soil Properties and Qualities' tab, the 'Bulk Density' tab next, followed by the 'On-third Bar'. Specify the 'Weighted Average' method and soil depth (0-30 cm, unless otherwise noted). Select 'View Ratings. The ratings will provide bulk density values for each soil type in the AOI. If the bulk density values are not available in the database, determine whether the soil orders are qualified as sandy, loamy, or clay using the 'Surface Texture' value in the Soil Properties and Qualities tab and then apply default values of 1.2 g/cm^3 for clay soils, 1.6 g/cm^3 for sand soils, and 1.4 g/cm^3 for loam soils.

Step 4: Sample for Soil Organic Matter (**Project Type 1**)

Soil carbon estimates are based on sampling soil organic matter for the project. Materials needed include:

- Rubber mallet

- Square spade (for removing organic material from core site)
- Soil probe
- Compass
- Trowel and/or sturdy knife (for cleaning soil off outside service of probe)
- Plastic bags (1 bag for each soil core)
- Marking pen
- Measuring tools (meters and centimeters)

Step 4a: Identifying the Plot Locations

Plots must be located randomly or systematically with a random start in each of the soil orders that occur on the project site. An adequate number of plots is needed to ensure the overall estimate of soil carbon meets or exceeds the minimum confidence levels stated in the Forest Protocol (+/- 20 percent at 90 percent confidence level). It is acceptable to use the same, or a subset of, plot locations as used for biomass sampling, so long as each soil order is sampled and the overall soil carbon estimate achieves the confidence standards stated above.

Step 4b: Identify Four Random Locations at Each Plot and Extract Soil Organic Matter Samples

4b-i: Select a random number by glancing at a watch's second hand (or digital version). Multiply this number by six to derive a compass bearing to use for the soil sample locations. Following the determined compass bearing, measure 10 meters from the plot center and establish each of the four soil sample locations. Minimal spatial adjustments (less than 2 meters) can be made to avoid rocks and roots from impacting the ability to sample. If obstacles cannot be avoided within 2 meters, an additional sample location must be selected using the method described above.

4b-ii: For each sample location, insert a soil core probe (minimum diameter, ½ inch) into the soil at the sample location to a depth of 30 cm. A rubber mallet may be used to facilitate penetration. If the probe will not penetrate to the required depth, the probe must be removed, wiped free of soil, and inserted in an alternate location with a 2 meter radius from the sample location. If repeated efforts result in difficulties achieving full penetration, an additional sample location must be chosen as described in Step 4b-i. If full penetration is not achieved within two efforts to locate a satisfactory sampling location, the sample must be taken from the initial sample location and the depth recorded.

4b-iii: Soil must be extracted carefully from the probe to avoid losing any of the soil collected. Should any soil be lost, the sample must be rejected and a new sample location selected as described above. The extracted soil is placed in a sealable plastic bag. Label the bag with the plot number followed by the letter "SOM", indicating the sample is a "soil organic matter" sample (not a bulk density sample).

4b-iv: Within 106 hours of the acquisition from the plot sites, the soil organic matter samples must be sent to a laboratory with expertise in analyzing soil carbon and physical properties, such as those that can demonstrate proficiency having taken part in the North American Proficiency Testing Program (NAPTP) for laboratories that provide soil sampling analysis, and in particular the voluntary Performance Assessment Program (PAP), offered as a part of the NAPTP.[46] If the laboratory conducting the analysis does not participate in the NAPTP, instructions must be sent with the samples indicating they are to be heated to over 1000

[46] Details on the NAPTP and the PAP can be found on the NAPTP website, here: https://www.naptprogram.org/.

degrees Celsius. This heat will burn off the carbon and a detector is to be used to measure the amount of carbon dioxide produced and reported as a percent of the volume sampled.

Step 5: Sample for Bulk Density (**Project Type 1**)

Sampling for soil bulk density must be conducted on the project site. Materials needed include:

- Rubber mallet
- Piece of wooden 2x4 approximately 1 to 2 feet in length
- Square spade
- Soil core/ring with known volume
- Trowel and/or sturdy knife
- Plastic bags (1 bag for each soil pit)
- Marking pen
- Measuring tools (meters and centimeters)

Step 5a: One random location 4 meters from each plot center must be selected for soil data collection to dig a soil pit to a depth of at least 30 cm^3. The measure of depth must be below the organic layer (branches, leaves, moss, etc.). The sides of the pit can be made straight using the trowel or the study knife. Random selection is achieved through the use of the second-hand method described in Step 4b-i. Adjustments to the location of the pit can be made using the adjustments allowed for difficulties associated with inserting soil probes described in 4b-ii.

Step 5b: Two samples will be taken from the soil pit. The sample is taken by centering the soil ring at a depth of 7.5 cm and the second is taken by centering the ring at a depth of 22.5 cm. The ring is inserted perpendicular to the pit face. The location of each insertion must be into undisturbed soil, as occurs during the process of extracting the soil rings. The soil pit can be expanded to ensure that undisturbed soil is sampled.

5b-i: For each of the samples the sharp end of the ring is pushed in, without twisting, as far as possible with the hands.

5b-ii: The piece of wood is placed over the ring and gently hammered evenly into the soil. If strong resistance is encountered, an alternate location may be found within the pit, or a new pit located using the guidance described above.

5b-iii: Using the trowel or sturdy knife, soil is removed around the outside of the ring to allow for extraction of the ring without losing soil. The surfaces of the ring should be cleaned and cut flush to the surface of the ring. Small losses during extraction and cleaning (up to 2 cm^3) can be restored by filling the void with soil from the pit site and smoothing. Samples must be rejected if soil losses from the ring occurring during extraction and cleaning are greater than 2 cm^3.

5b-iv: The soil from both ring samples is placed in one sealable plastic bag and labeled with BD and the plot number.

5b-v: Within 106 hours of the acquisition from the plot sites, the bulk density samples must be sent to laboratory with expertise in analyzing soil carbon and physical properties, such as those that can demonstrate proficiency having taken part in the North American Proficiency Testing Program (NAPTP) for laboratories that provide soil sampling analysis, and in

particular the voluntary Performance Assessment Program (PAP), offered as a part of the NAPTP. If the laboratory conducting the analysis does not participate in the NAPTP, instructions must be sent with the bulk density samples shall describe that the samples are to be dried at 105 degrees centigrade for at least 48 hours and that all portions of the sample are to be retained (including rocks). The laboratory shall present the results of the analysis of bulk density estimates as g/cm^3, displaying dry weight over total sample volume.

Step 6: Calculate the Total Soil CO_2 per Acre (**Project Types 1 and 2**) Use Equation B.4 (below) to calculate the soil CO_2 per acre.

Equation B.4. Soil CO_2e per Acre

Soil CO_2e	=	Organic Matter Value (Steps 2 or 4) **x** 0.58 (Conversion of Organic Matter to Carbon) **x** Bulk Density Value (Steps 3 or 5) **x** Soil Depth Sampled (30 cm) **x** 40,468,600 (Conversion of 1 cm^2 to 1 acre) **x** 10^{-6} (Conversion of 1 gram to 1 metric ton) **x** 3.667 (Conversion of Carbon to CO_2)

An example is provided in Table B.13 below.

Table B.13. Example: Calculation for Total CO_2 per Acre

Organic Matter from Steps 2 or 4		0.05
Conversion of Organic Matter to Carbon	x	0.58
Bulk Density (g/cm^3) from Steps 3 or 5	x	1.2
Soil Depth Sampled (30 cm)	x	30
Conversion of 1 cm^2 to 1 acre (1 acre = 40,468,600 cm^2)	x	40,468,600
Conversion of 1 gram to 1 metric ton Carbon	x	0.000001
Conversion of 1 metric ton Carbon to 1 metric ton CO_2	x	3.667
Estimated Metric Tons CO_2 per Acre	=	155.05

Step 7: Quantify the Project Effects on Soil CO_2e (**Project Types 1 and 2**)

Project effects are calculated using the standardized guidance below. Avoided Conversion projects must use the standardized guidance for purposes of estimating project benefits. Soil carbon emissions resulting from management activities are determined where the activity, or set of activities, leads to a net loss of soil carbon across the entire project. Net emissions can occur across the project area in a sustainably managed forest where emissions from management activities are not restored during the rest, or growth, cycle of the stand. The default values provided are derived from scientific literature and address the high-end estimates of net emissions associated with management activities, except in the case of conversion where it is more conservative to underestimate the emissions associated with the avoided activity.

Default emission values are provided as percentages for each soil order, based on harvesting intensity, site preparation intensity, and the frequency of disturbance. Project Operators must report their soil carbon emissions by grouping the total acres in each permutation, or class of soil order, harvesting intensity, site preparation intensity, and frequency of disturbance, rather than reporting on an individual stand basis. An example of reporting classes of management activities is provided below, following the descriptions of the management activities.

Net carbon emissions are estimated as the difference between carbon stocks (CO_2e) in the soil prior to the management activity and the carbon stocks (CO_2e) in the soil immediately prior to the subsequent harvest event for each harvested stand. Index values are provided for both harvesting intensity and site preparation intensity that, when combined, classify the harvesting intensity for the stand. The index value for harvesting intensity is derived from both the amount of biomass removed during harvest and the soil disturbance associated with the biomass removal. The index value for site preparation is based on the amount of soil disturbance associated with site preparation activities.

For each stand harvested in a given reporting year, Project Operators must determine the harvesting intensity using the guidance below. For Avoided Conversion projects, the guidance is used below to assist in determining baseline conditions and applied to the project rather than individual stands.

Step 7a: Harvesting Intensity

First, the biomass removal index value is determined for the stand based on the amount of biomass removed during harvest. The harvesting intensity value is calculated using a factor for the amount of biomass removed and the amount of soil disturbance that occurs removing the biomass. Both values are added together to calculate the harvesting intensity. The value for disturbance related to biomass removal is determined using Table B.14 below:

Table B.14. Determination of Biomass Removal Index

Biomass Affected by Harvest		
Percentage Pre-Harvest Aboveground Biomass Removed	**Silviculture Activities Generally Associated with Level of Biomass Removed**	**Biomass Removal Index**
< 10%	Sanitation Salvage	0
10 – 50%	Selection, Thinning	0
51 – 80%	Rotation harvest with biomass remaining in tree tops, seed/shelterwood and/or retained trees	1
> 80%	Rotation harvest with whole tree harvesting and little retention	2
Not a Silvicultural Activity – There is no intent to follow up with efforts to regenerate forested conditions		
Based on Table 6.4 in the Forest Protocol	Conversion – only relevant to assessment of Avoided Conversion baseline	10

Step 7b: Soil Disturbance from Harvesting Activities

The second value considered for determining the harvest intensity is based on the level of soil disturbance associated with biomass removal. Soil disturbance within the harvested stands boundary may be the result of skidding logs, tree falling, and harvesting equipment. The disturbance may be extensive or minimized, depending on site-specific conditions and

care taken during harvesting operations. The soil disturbance index is based on the amount of mineral soil (below the organic layer, including litter and duff) exposed due to harvest activities. The determination of the amount of mineral soil disturbance is from ocular inspection of harvested stands. Table B.15 below is used to determine the soil disturbance index from harvesting.

Table B.15. Determination of Soil Disturbance Index

Percent of Mineral Soil Exposed during Harvest	Soil Disturbance Index
< 5%	0
5 - 20%	2
20 - 40%	3
40 - 60%	4
> 60%	5

Step 7c: Determining the Harvesting Intensity Class

The values for the biomass removal index and the soil disturbance index are summed together to determine the harvesting intensity class, displayed below in Table B.16.

Table B.16. Harvesting Intensity Classes based on Summing the Biomass Removal and Soil Disturbance Indexes

Harvesting Intensity Classes	
Harvesting Intensity Class	**Sum of Biomass Removal and Soil Disturbance Indexes**
Light to Medium	< 3
High	3 - 4
Very High	5 - 7
Conversion	> 7

Step 7d: Determining Site Preparation Classes

For each stand harvested, the Project Operator must determine the site preparation index using the guidance in Table B.17.

Table B.17. Site Preparation Classes and Descriptions of Management Activities

Site Preparation	
Site Preparation Class	**Description**
Very Light	Less than 5% surface area disturbance of soil below litter and duff due to ripping, grading, raking, etc.
Light	5% to 24% surface area disturbance below litter and duff due to ripping, grading, raking, etc.
Medium	25% to 59% surface area disturbance below litter and duff due to ripping, grading, raking, etc.
Heavy	60% to 100% surface area disturbance below litter and duff due to ripping, grading, raking, etc.
Conversion	Soils cleared of trees, stumps and other forest vegetation and prepared for agriculture, grazing, and/or development. No return to forest vegetation.

Step 7e: Determining the Frequency of Disturbance

The frequency of disturbance is determined as the time between harvest activities associated with the specific silviculture event that is being evaluated for soil carbon emissions. The value for frequency of disturbance is assigned to each harvested stand based on the amount of pre- harvest basal area remaining in the post-harvest stand. The standardization of these values is based on protocol requirements that onsite forest carbon stocks be maintained or increased and the minimum rotation age in even-aged management silviculture effectively set at 50 years.

Table B.18. Frequency of Disturbance Classification

Frequency of Disturbance	Harvest Retention	Assumed Years to Next Harvest
Short	> 75% of pre-harvest basal area	Up to 15 years
Medium	51 – 75% of pre-harvest basal area	16 to 35 years
Long	26 – 50% of pre-harvest basal area	36 to 50 years
Very Long	< 26% or pre-harvest basal area	> 51 years

Step 7f: Determining Emissions Associated with Management Activities

For each class of harvested stands, or stands that have received site treatment, a value is determined for each combination of harvest intensity, frequency of disturbance, site preparation, and soil order. A percent value is derived from Table B.19 below based on the combination of the various classes.

Table B.19. Estimated Net Carbon Loss

Harvesting Intensity	Frequency of Disturbance	Site Treatment	Estimated Net Carbon Loss by Soil Order						
			Alfisol	***Andisol***	***Inceptisol***	***Mollisol***	***Spodosol***	***Ultisol***	***Histosol***
Light to Medium	Short	Very Light	0%	0%	0%	0%	0%	0%	80%
	Medium		0%	0%	0%	0%	0%	0%	80%
	Long		0%	0%	0%	0%	0%	0%	80%
	Very Long		0%	0%	0%	0%	0%	0%	80%
High	Short	Very Light	Conifers 0% Hardwoods 20%	0%	8%	0%	10%	9%	80%
		Light	Conifers 5% Hardwoods 20%	5%	8%	5%	10%	9%	80%
		Medium	Conifers 10% Hardwoods 20%	10%	10%	10%	20%	11%	80%
		Heavy	Conifers and Hardwoods 20%	20%	20%	20%	41%	22%	80%
	Medium	Very Light	Conifers 6% Hardwoods 20%	0%	0%	0%	33%	24%	80%
		Light	Conifers 6% Hardwoods 20%	5%	5%	5%	33%	24%	80%
		Medium	Conifers 10% Hardwoods 20%	10%	10%	10%	33%	24%	80%
		Heavy	Conifers and Hardwoods 20%	20%	20%	20%	41%	24%	80%
	Long	Very Light	Conifers 0% Hardwoods 20%	0%	0%	0%	31%	0%	80%
		Light	Conifers 5% Hardwoods 20%	5%	5%	5%	31%	5%	80%
		Medium	Conifers 10% Hardwoods 20%	10%	10%	10%	31%	11%	80%
		Heavy	Conifers and Hardwoods 20%	20%	20%	20%	41%	22%	80%
	Very Long	Very Light	0%	0%	0%	0%	5%	0%	80%
		Light	0%	0%	0%	0%	10%	5%	80%
		Medium	0%	0%	0%	0%	20%	11%	80%
		Heavy	0%	0%	0%	0%	41%	22%	80%
Very High	Short	Very Light	Conifers 6% Hardwoods 20%	6%	28%	6%	1%	6%	80%

Harvesting Intensity	Frequency of Disturbance	Site Treatment	Estimated Net Carbon Loss by Soil Order						
			Alfisol	***Andisol***	***Inceptisol***	***Mollisol***	***Spodosol***	***Ultisol***	***Histosol***
		Light	Conifers 6% Hardwoods 20%	6%	28%	6%	10%	6%	80%
		Medium	Conifers 10% Hardwoods 20%	10%	28%	10%	20%	11%	80%
		Heavy	Conifers and Hardwoods 20%	20%	53%	20%	41%	22%	80%
	Medium	Very Light	Conifers 6% Hardwoods 20%	6%	6%	6%	0%	5%	80%
		Light	Conifers 6% Hardwoods 20%	6%	6%	6%	10%	6%	80%
		Medium	Conifers 6% Hardwoods 20%	10%	10%	10%	20%	11%	80%
		Heavy	Conifers and Hardwoods 20%	20%	20%	20%	41%	22%	80%
	Long	Very Light	Conifers 6% Hardwoods 20%	5%	6%	6%	0%	6%	80%
		Light	Conifers 6% Hardwoods 20%	6%	6%	6%	10%	6%	80%
		Medium	Conifers 6% Hardwoods 20%	10%	10%	10%	20%	11%	80%
		Heavy	Conifers and Hardwoods 20%	20%	20%	20%	41%	22%	80%
	Very Long	Very Light	Conifers 6% Hardwoods 6%	6%	6%	6%	0%	6%	80%
		Light	Conifers 6% Hardwoods 6%	6%	6%	6%	10%	6%	80%
		Medium	Conifers 6% Hardwoods 6%	6%	6%	6%	20%	6%	80%
		Heavy	Conifers 6% Hardwoods 6%	6%	6%	6%	41%	6%	80%

Harvesting Intensity	Frequency of Disturbance	Site Treatment	Estimated Net Carbon Loss by Soil Order						
			Alfisol	***Andisol***	***Inceptisol***	***Mollisol***	***Spodosol***	***Ultisol***	***Histosol***
Conversion	Conversion	Agriculture	30%	30%	30%	30%	30%	30%	80%
		Residential - Commercial	0%	0%	0%	0%	0%	0%	80%
		Timing of Estimated Emissions	30% in first 10 years	30% in first 10 years	30% in first 10 years	30% in first 10 years	30% in first 10 years	30% in first 10 years	8% every 10 years over 100 years

This percentage is multiplied by the soil carbon (CO_2e) estimate on a per acre basis and multiplied by the stand's acres to determine the emissions to report for each stand. The stand emissions are summed to determine the soil carbon emissions (CO_2e) reported annually. An example of the calculation is provided in Table B.20 below.

Table B.20. Example: Calculations for Annual Soil Carbon Reporting

Reporting Year			**2012**						
A	B	C	D	E	F	G	H	I	J
Stand ID	Soil Order	Soil Carbon (tCO_2e) per Acre	Acres	Stand Soil Carbon (tCO_2e)	Harvesting Intensity	Disturbance Frequency	Site Preparation	Estimated Soil Carbon Loss %	Stand Soil Carbon Loss (tCO_2e)
	From Step 1	From Step 6		C **x** D	From Step 7a	From Step 7e	From Step 7d	Table B.19	I **x** E
1	Alfisol	85	595	50,575	Very High	Very Long	Heavy	6%	3,035
2	Alfisol	85	683	58,055	Light - Medium	Short	Very Light	0%	-
3	Alfisol	85	2,232	189,720	High	Long	Light	5%	9,486
Sum of Soil Carbon Emissions (tonnes CO_2e) for 2012									**12,521**

B.15 Onsite Carbon Stocks Affected by Site Preparation Activities with Reforestation Projects

The removal of standing dead trees, brush, and downed logs associated with Reforestation Projects may constitute a significant quantity of emissions compared to the project benefits in the short term. Therefore, Reforestation Projects must estimate the biological emissions associated with site preparation activities prior to planting trees.

For carbon pools that will be affected by site preparation, an inventory of the pools that will be affected must be conducted prior to any site preparation activities. For those carbon pools that are affected by site preparation, Project Operators must provide an estimate of initial carbon stocks using one of the following alternatives:

- Measuring carbon stocks using 20 randomly placed sample plots located in the portion of the project area containing the greatest amount of biomass in the pool or pools that will be affected. The portion of the area sampled shall be calculated. The estimate derived on a per acre basis shall be applied to the balance of the project area.

- Stratifying (classifying) the project area into similar densities and measuring stocks within the affected carbon pools using 20 randomly located sample plots per density class.

- Measuring the affected carbon stocks based on a systematic grid system across the project area.

B.16 Total Onsite Carbon Stocks and Calculating the Confidence Deduction

Annual reporting is conducted by summing the carbon stocks present at the end of the reporting period in all of the relevant carbon sources, sinks, and reservoirs for the project. Certain reported pools are sampled and the mean estimate is used for annual reporting. The number reported for the sampled pools 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[48] of the inventory estimate (for each pool or combined pools where applicable, such as with standing live and dead wood).

Step 2: Multiply the standard error by 1.645.

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.

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

Table B.21. Example: Summing All Onsite Carbon Stocks and Calculating the Confidence Deduction

Carbon Pool	Source of Data	Project Type(s)	Required/ Optional	Mean CO_2e (Tonnes per Acre)	Sampling Error at 90% Confidence Level	Sampling Error as a Percentage of the Mean Carbon Pool Estimate
Data Derived from Sampling						
				Example Data		
Standing Live Trees	Sampled within project boundaries	All project types	Required	95	6	6.32%
Standing Dead Trees	Sampled within project boundaries	All project types	Required	6	2	33.33%
Soil Carbon	Sampled within project boundaries	Avoided Conversion	Optional	65	8	12.31%
				Sum of Reported Pools	Calculation of Combined Sampling Error	Calculation of Combined Sampling Error as a Percentage
Summarizing Sampled Data				All Reported Pools from Sampling	Combined Sampling Error as a Percentage*Sum of All Reported Pools from Sampling Used to Determine the Confidence Deduction	$U_S = \frac{((U_1 \mathbf{x} R_1)^2+(U_2 \mathbf{x} R_2)^2+ \ldots+(U_n \mathbf{x} R_n)^2)^{\wedge}0.5}{\lvert R_1 + R_2 + \ldots + R_n \rvert}$ *Where*, U_S = percentage uncertainty of the sum U_i = percentage uncertainty associated with pool *i* R_i = removal (emission) estimate for pool *i*
Summary of Example Data from Sampled Pools				**166**	**10.20**	**6.14%**
Data Not Derived from Sampling						
Soil Carbon Emissions	Standardized Guidance	All Projects	Required	-5 (Example)	NA Not Subject to Sampling Error	NA Not Subject to Sampling Error
Sum of Onsite CO_2e Tonnes				**156**	**NA**	**NA**

The per-acre unit must be expanded to the project area based on the number of acres in the project. The sum of onsite CO_2e tonnes for the project is input into the calculation worksheet for annual reporting.

B.17 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 actual 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 Operators are required each year to apply a confidence deduction to the inventory of actual onsite carbon stocks. 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 each reporting period.

The confidence deduction must be updated each time the project is subject to a site visit verification but must remain unchanged between verification site visits. If increased sampling over time results in a lower confidence deduction at the time of a site visit verification, the lower deduction may be applied to inventory estimates in all previous years. will issue Ecology offsets in the current year for any increase in quantified GHG reductions and removals in prior years associated with the new (lower) confidence deduction. Conversely, if a loss of qualified sampling plots results in a higher confidence deduction, this higher deduction must also be applied to inventory estimates in all previous years. Any resulting decrease in creditable GHG reductions and removals for prior years will be treated as an intentional reversal and must be compensated for by retiring offsets in accordance with WAC 173-446-570.

B.18 Applying a Confidence Deduction to Non-Aggregated Projects

The target sampling error for the combined inventory estimates for non-aggregated projects is +/- 5 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 process for calculating the combined sampling error at the 90 percent confidence level is shown above. The combined sampling error must be compared to the table below to determine the confidence deduction for the reporting period in which a site visit verification has occurred. The confidence deduction shall not be modified in the interim years between site visit verifications. The percent deduction from the table below is input into the calculation worksheet which calculates the net reported onsite stocks.

Table B.22. 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 5%	0%
5.1 to 19.9%	(Sampling Error – 5%) to the nearest 1/10 percentage
20% or greater	100%

B.19 Applying a Confidence Deduction for Aggregated Projects

The target sampling error for the combined inventory estimates for aggregated projects is on a sliding scale based on the number of projects participating within the aggregate. Project Operators enrolled in an aggregate may submit project inventories with reduced sampling requirements based on the statistical principle that the targeted standard error (+/- 5 percent of the mean at the 90 percent confidence level) is achieved across the entire aggregate. Refer to the Guidelines for Aggregating Forest Projects [Appendix C] for the targeted sampling error for individual aggregate participants.

B.20 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 protocol 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 Forest Protocol'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 annual 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, in a given reporting year, 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 Climate Action Reserve has developed a spreadsheet tool to assist in the calculation of harvested wood products, which is available on the Climate Action Reserve's Forest Protocol webpage. The Harvested Wood Products Calculation Worksheet contains step by step instructions for its use. Project reporting of harvested wood products occurs on an annual basis. The volume of logs delivered to the mill in the baseline case remains static throughout the project life. However, the mill efficiencies and the wood product classes identified in a reporting period are applied to the baseline harvested wood products the same way they apply to the project harvested wood products. The intent of this policy is to provide the best comparison of project activity to baseline activity possible.

The spreadsheet is designed with default values for converting volumetric units from logs delivered to mills to cubic feet and the values of mill efficiencies to be used on a geographic basis. The annual reporting of carbon in trees harvested for wood products is based on the relative proportion of volume in trees harvested for wood products and volume delivered to the mill(s) in the baseline case. Therefore, the reporting of volume delivered to mills is essential to calculating the volume in trees harvested for wood products.

Mill efficiency estimates from the actual mills the project logs are delivered to can be used if data exists to support the claim in a form that can be verified. Users must identify the mill(s) the project logs are delivered to and input the volume that is manufactured into lumber, plywood, oriented strand board, non-structural panels, miscellaneous products, and paper/pulp. Where the wood product class is unknown, the Project Operator must classify the product as miscellaneous products. In order to quantify unknown products categorized as miscellaneous conservatively, miscellaneous products are assigned a default storage factor of zero.

Project Operators must provide an affidavit from the mill that the reported wood product classes are reasonable according to production records at the mill, unless they use the default product classes provided in the Assessment Area Data file. Again, the wood product classes reported for a given reporting year apply both to the project and the baseline case which eliminates the calculation of project benefits or detriments based on comparisons of the decay rates of wood products alone.

B.21 Improved Forest Management Leakage

Secondary Effects, or leakage, reflect market responses to changes in harvesting levels. The general assumption in this protocol is that modifying harvest in a Forest 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 Forest Project relative to baseline levels, the greater the response by the market to compensate.

Market leakage effects are accounted for under Improved Forest Management Projects by considering the impacts of shifting activities over the life of the project. Recognizing that risk of Secondary Effects from a project may be influenced by long term harvesting trends, the evaluation in Equation 6.5. Secondary Effects Emissions of the Forest Protocol considers cumulative harvest amounts since project inception. In some years, Secondary Effects may be negative, if project harvesting is below baseline harvesting (on both a cumulative and individual reporting period basis). If project harvesting later increases, deductions for prior negative Secondary Effects can be recouped. However, once all prior negative Secondary Effects are recouped, Secondary Effects when actual harvested carbon exceeds baseline harvested carbon are zero – under no circumstances shall the net balance of the Secondary Effects over the course of a project be positive. However, positive Secondary Effects may accrue as uncredited positive carryover that can counteract the amount of future negative Secondary Effects applied if baseline cumulative harvested carbon were to exceed actual harvested carbon again.

Accruals of positive Secondary Effects carryover and their application against future negative Secondary Effects, if they occur, are calculated within the calculation worksheet.

Table B.23. Examples: How Secondary Effects Can Be Recouped and Positive Carryover Can Be Applied Over Time

a. Qualitative example

Reporting Period	Greater of Actual or Baseline		Protocol Equation Reference	Secondary Effect
	Annual	Cumulative		
1	Baseline	Baseline	Equation 6.5.B	Negative Secondary Effect resulting in deduction applied to GHG reductions
2	Actual	Baseline	Equation 6.5.B	Positive Secondary Effect resulting in recouping of previously deducted GHG reductions up until the cumulative Secondary Effect is zero
3	Actual	Actual	Equation 6.5.A	No Secondary Effect, excepting any previous negative Secondary Effect deductions that have not been recouped and including any positive Secondary Effects that are carried over to the following year
4	Baseline	Actual	Equation 6.5.C	No Secondary Effect, though adjusting any positive Secondary Effect carryover and carrying forward any remaining balance to the following year
5	Baseline	Baseline	Equation 6.5.B	Negative Secondary Effect resulting in deduction applied to GHG reductions, with deduction lowered by any positive secondary effects carryover from when actual cumulative harvest carbon exceeded baseline cumulative harvested carbon

b. Quantitative example

Reporting Period	1	2	3	4	5
Annual actual carbon in harvested trees	500	**1,400**	**1,400**	800	800
Annual baseline carbon in harvested trees	**1,000**	1,000	1,000	**1,000**	**1,000**
Cumulative actual carbon in harvested trees	500	1,900	**3,300**	**4,100**	4,900
Cumulative baseline carbon in harvested trees	**1,000**	**2,000**	3,000	4,000	**5,000**
Cumulative difference between actual and baseline C in harvested trees	(500)	(100)	300	100	(100)
Annual difference between actual and baseline C in harvested trees	(500)	400	400	(200)	(200)
Gross annual Secondary Effects	(100)	80	80	(40)	(40)
Adjusted gross annual Secondary Effects, not allowing positive cumulative Secondary Effects but not including positive Secondary Effects carryover	(100)	80	20	0	(40)
Carryover of positive Secondary Effects from prior year	NA	0	0	60	20
Net annual Secondary Effects	**(100)**	**80**	**20**	**-**	**(20)**

B.22 Modeling Carbon Stocks

This protocol requires the use of certain empirical models to estimate the baseline carbon stocks and project stocks of selected carbon pools within the project area for private land IFM projects (with the exception of the IFM default baseline approach). These models may also be used to supplement assessments of actual changes in carbon stocks resulting from the forest project.

B.23 Models and their Eligibility for Use with Forest Projects

Empirical models are used for estimating existing values where direct sampling is not possible or cost-effective. They are also used to forecast the estimations derived from direct sampling into the future. Field measurements (standing live and dead trees) provide the base input data for these models. Project Operators 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 have two basic functions in the development and management of a forest project. Models project the results of direct sampling through simulated 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.

Models are also used to assist in updating inventory plots so that the plots can represent a reporting year subsequent to their actual sample date. The model simulates the diameter and height increment of sampled trees for the length of time between their sampled date and the reporting year. Plot data can be projected for the length of time the projection method is expected to accurately reflect actual forest growth. Inaccurate updating of plot data can lead to the inability of a project to be verified. Verifiers are directed to randomly select plots or stands for verification. If the Project Operator's estimates deviate from the verifier's measurements, the verification will fail. Hence, it is required that plot data be no older than 12 years.

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
- SPS: Stand Projection System
- FPS: Forest Projection System
- CRYPTOS Emulator
- FORESEE

A Project Operator may update inventory plot data for estimating diameter and height growth by incorporating data obtained from sample plots, as in a stand table projection. An example of an appropriate method of applying a stand table projection is as follows:

1. The project area is stratified into even-age management and uneven-age management.

2. Diameter increment shall be based on the average annual increment of a minimum of 20 samples of radial growth for diameter increment for each 8 inch diameter-at- breast-height (DBH) class, beginning at 0 to 8 inch DBH for each management type (even-age or uneven-age). The average annual increment shall be added for each year according to the plot's sample date.
3. Height increment is based on regression curves for each management type (even- age or uneven-age) developed from height measurements from the same trees the diameter increment data was obtained. The estimated height shall be determined using the regression estimators for the 'grown' diameters as described above.

   Ecology 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

B.24 Using Models to Forecast Carbon Stocks

The use of simulation models is required for estimating a forest project's baseline carbon stocks (with the exception of projects using the Improved Forest Management default baseline approach). Models may also be required to forecast actual carbon stocks expected under the forest project (e.g., in conjunction with determining expected harvesting volumes or in updating forest carbon inventories).

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 protocol. Standing dead trees must be assumed to be static over the baseline modeling. Exceptions to this rule are allowed if approved in writing Ecology prior to verification.

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

B.25 Modeling Requirements

A modeling plan must be prepared that addresses all required forecasting of baseline carbon stocks for the forest project (with the exception of projects using the Improved Forest

Management default baseline approach). The modeling plan shall contain the following elements:

1. A description of all silviculture methods modeled. 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. 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 and an explanation of the source of the site index values used.
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.
2. 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.

Appendix C. Guidelines for Aggregating Forest Projects

Note: These guidelines are adopted, with alternations, from the Climate Action Reserve's Guidelines for Aggregating Forest Projects, 2017

C.1 Introduction

The goal of aggregation is to help mitigate project development costs for individual landowners and facilitate small landowner project development per RCW 70A.65.170(4)(e) while aligning with the offset project requirements established in RCW 70A.65.170(2). Allowing smaller projects to register as part of a group, or "aggregate", can help reduce costs by enabling economies of scale and supporting the marketing of offset credits at volume.

- The approach to aggregation works as follows:
- Only projects of less than 5,000 acres may enroll in an aggregate. No Forest Owner may enroll more than 5,000 acres in aggregates (single or multiple).
- Each project must register individually, per WAC 173-446-520.
- Individual Forest Owners must each sign the attestations required in WAC 173-446-520(3). Liability for intentional reversals lies with each individual Forest Owner.
- Aggregators must select verification bodies, coordinate verification schedules, and register with Ecology per WAC 173-446-520(1)
- Aggregators may also engage in project development, manage monitoring, and provide other services for the Forest Owner. The scope of aggregator services is up to negotiation between each Forest Owner and Aggregator and reflected in the contracts between the Forest Owner and the Aggregator.
- By enrolling in an aggregate, a project will:
  - Require fewer sample plots to generate a forest carbon inventory of sufficient statistical certainty to avoid a confidence deduction. Greater statistical uncertainty associated with individual project areas will be compensated through aggregation with other projects. Allowable standard errors for individual projects are established based on the total number of participating projects in the aggregate.
  - Have a less frequent verification schedule than is required for standalone projects.
- All individual projects within an aggregate must demonstrate Direct Environmental Benefits to Washington, per WAC 173-446-595.
- Projects within an aggregate may extend across multiple assessment areas within an ecosection or supersection, but may not extend across more than two adjacent ecosections or supersections.

C.2 Proposed Aggregation Guidelines

This model of aggregation enables small projects to participate in the Cap-and-Invest program by allowing the forest inventory and verification requirements of the project to be applied at an aggregate level rather than at the level of individual projects. Participation in an aggregate in no way changes how a project determines its baseline, meets sustainable harvesting and natural forest management requirements, or meets requirements for submitting annual monitoring reports.

C.2.1 Eligible Project Types

Aggregates may be comprised of any combination of the eligible project types defined in the section 2.1 of this protocol. Participants in an aggregate can be a mix of projects with private

and/or public ownership.

C.2.2 Number of Landowners

An aggregate must consist of two or more individual forest projects. There is no limit to the number of projects in an aggregate. The forest inventory sampling and project verification requirements for individual projects within an aggregate vary depending on the total number of projects in the aggregate.

C.2.3 Acreage Limitations

There is no upper or lower limit on the total amount of forest area enrolled in an aggregate. However, an individual Forest Owner may enroll only up to 5,000 acres in aggregates, whether in a single aggregate or across multiple different aggregates. Area owned by an individual Forest Owner may be enrolled in aggregates as either a single 5,000-acre project or as multiple projects adding up to 5,000 acres. Any forest projects that would cause the Forest Owner to exceed the 5,000-acre limit must be submitted on a standalone basis.

In aggregates formed by three or more projects, no single project may comprise more than 50 percent of the total combined area in an aggregate. This is to prevent any one project from disproportionately affecting the inventory statistics and having excessive influence on the composite sampling error. In the case of aggregates formed from two projects, no single project may comprise more than 70 percent of the total combined area in the aggregate.

C.2.4 Qualifications and Role of Aggregators

An Aggregator may be a corporation or other legally constituted entity, city, county, state agency, individual or a combination thereof. An Aggregator must be registered with Ecology as an offset project operator per WAC 173-446-055(a)(ii). A Forest Owner may serve as its own Aggregator or as an Aggregator for a group of projects when it is the owner of one or more of the projects.

Once approved for an account as an Offset Project Operator, an Aggregator must remain in compliance with the registration requirements described in WAC 173-446-055. Aggregators shale

- Execute contracts with Forest Owners that include the mandatory components as defined below in Joining an Aggregate, Section 2.6.
- Select a single verification body for all enrolled projects in any given year or set of years.
- Ensure the verification schedule for all projects in the aggregate meets the verification standards according to this protocol and these guidelines. (See Monitoring and Verification, Section C.2.10.)
- Maintain a tracking system account to which Ecology offsets will be issued

Forest Owners are ultimately responsible for submitting all required forms and complying with the terms of the protocol. Aggregators may, however, manage the flow of ongoing monitoring and verification reports as a service to Forest Owners. Aggregators may also engage in project development, provide inventory services, and provide other services for the Forest Owner. The scope of aggregator services may be negotiated between Forest Owners and the Aggregator and reflected in contracts between the Forest Owners and the Aggregator.

C.2.5 Forming an Aggregate

Aggregators must submit an "Aggregator Document" to Ecology and the approved offset project registry that includes the following information:

- The name, description, and contact information of the Aggregator.
- Proof of incorporation and/or good standing as corporate entity or other legally constituted entity, city, county, state agency, individual or a combination thereof.
- A list of initial Forest Owner participants (which must be greater than one).

The Aggregator Document will be available to the public on the offset project registry's website and will require approval offset project registry staff. It must be modified any time a participant joins or leaves an aggregate (triggered by the submission of an "Aggregate Entry" or "Aggregate Exit" form as described below).

C.2.6 Joining an Aggregate

To join an aggregate, Forest Owners will be required to submit an Aggregate Entry form. This form may be included at the time of project submittal, or at any time thereafter. This form will require the approved offset project registry staff's approval and will contain:

- Statement that the Forest Owner wishes to join a specific aggregate with a specific Aggregator. A participating project may only have one Aggregator.
- Copies of any contract(s) between Forest Owner and Aggregator. Forest Owners may decide whether or not contracts with Aggregators are made available to the public.

Once the Aggregate Entry form is submitted, projects must undergo a site-visit verification before they will be allowed to join the aggregate.

C.2.7 Leaving an Aggregate or Termination of Contract between Forest Owner and Aggregator

To leave an aggregate, the Forest Owner for a project is required to submit an Aggregate Exit form. This form includes:

- A statement that the Forest Owner intends to withdraw a project from a specific aggregate and Aggregator.
- If Forest Owner intends to retain a standalone compliance offset project, a statement that the Forest Owner understands that they will be required to meet the standalone project inventory standards and that they will not be issued further credits until they have met those inventory standards and their new inventory has been verified.
- If the Forest Owner intends to enroll the project in a different aggregate, rather than switching to a standalone project, it will have 24 months to do so. During such time as the project is not enrolled in an aggregate, account activities will be suspended. After 24 months, the project will be required to meet the requirements of a standalone project.
- In the event that a project leaving an aggregate changes the targeted standard error for the projects remaining in the aggregate (because there are fewer than 15 projects remaining – see Table 2.1, below), either (a) a new project must be added to the aggregate within 12 months of the departure date of the exiting project, or (b) new targeted standard error levels will apply to all of the remaining participants based on the number of remaining projects.

C.2.8 Forest Owner registration requirements

Each Forest Owner must be identified in the required Project Listing and Offset Project Data Reporting Forms and complete all applicable attestations required in WAC 173-446-520. Each project is required to contribute to Ecology's buffer pool, and buffer pool contributions shall be determined for each individual project within the aggregate. Each

Forest Owner within an aggregate must compensate for reversals that occur on the forest land on which they have an ownership interest, as described in WAC 173-446-570.

All participants in the aggregate who intend to receive Ecology offset credits must maintain registration with Ecology per WAC 173-446-055(a)(ii). Aggregators must maintain active registration per WAC 173-446-055(a)(ii).

C.2.9 Inventory Standards for Participating Projects

The target sampling error for inventory samples for projects developed through this protocol is +/- 5 percent of the mean at the 90 percent confidence level. Projects that cannot meet this target level are still eligible but may have to take a "confidence deduction" that reduces their reported carbon stocks. To achieve +/- 5 percent of the mean at the 90 percent confidence level can be prohibitive for smaller projects because it requires a large number of plots relative to the total area of the project. Under these aggregation rules, Forest Owners enrolled in an aggregate may submit project inventories with reduced sampling requirements based on the statistical principle that the targeted standard error (+/- 5 percent of the mean at the 90 percent confidence level) is achieved across the entire aggregate.

For aggregated projects, the sampling error allowed for inventory data associated with individual forest projects varies on a sliding scale based on the number of participating projects. This sliding scale was determined through consultation with statisticians and affirmed by a model exercise as described in Appendix A. The target sampling error for the individual projects ranges between 7 to 10 percent of the mean at the 90 percent confidence level based on the total number of projects in the aggregate as shown in Table 2.1 below. The same targeted sampling error applies to all projects in an aggregate.

Table 2.1. Target Sampling Error at the 90 Percent Confidence Level for Projects Participating in an Aggregate

Number of Participating Projects in the Aggregate	Target Sampling Error (TSE)
2	7%
3	8%
4	9%
5+	10%

For projects in an aggregate, confidence deductions are determined according to Table 2.2 below, using the appropriate TSE from Table 2.1.

Table 2.2. Inventory Confidence Deductions for Participating Projects in an Aggregate

Actual Sampling Error at 90% Confidence Level	Confidence Deduction
0 - TSE%	0%
TSE to 20%	(Actual sampling error – TSE %) to the nearest 1/10th per cent
Greater than 20%	100%

Using this approach, the inventory standard remains essentially the same for single large projects and aggregated groupings of smaller projects while allowing the smaller projects in an aggregate to benefit from reduced costs associated with the reduced number of plots required per project.

C.2.10 Monitoring and Verification

Each project is required to undergo a site-visit verification at the project's initiation to confirm that the baseline and initial inventory have been established in conformance with the protocol and that the rules for inventory accuracy have been met as outlined in this document.
Subsequent verifications may follow a schedule where only a representative sample of projects in an aggregate is verified each year, as described below.

The Aggregator is responsible for selecting a single verification body for all enrolled projects in any given year or set of years. The same verification body may be used up to six consecutive years. The requirements for verifications and verification bodies are established in WAC 173-446-535 and WAC 173-446-540.

The Aggregator must also coordinate a verification schedule that meets the requirements described in this section. The Aggregator must document the verification work and provide a report to the Ecology every 12-month period, from the date of its formation, showing how the verification schedule demonstrates compliance with these guidelines.

C.2.10.1 Required Site-Visit Verification Schedule for Aggregates

Site-visit verifications must be conducted on a schedule such that at all times a minimum of 50 percent of the projects in the aggregate (rounding up in the case of an uneven number of projects) have successfully completed a site-visit verification within the previous six years, and that 100 percent of the projects have successfully completed a site-visit verification within the previous twelve years. These verification requirements are mandatory regardless of the mix of entry dates represented by the group of projects in the aggregate. The initial site-visit verification required for entry into the aggregate may count to meet these site verification obligations.

On six-year intervals, beginning with the first year of the existence of the aggregate, the verification body must select from the total group of projects those projects that will have scheduled site-visit verifications in order to meet these obligations. The process should utilize random selection to the degree possible and still meet the six- and twelve-year completion requirements. For example, in the case where there are ten projects that joined the aggregate in the first year, five of those projects should be chosen randomly to have a site-visit verification sometime before the seventh year. The site-visit verifications may be spread out through each six-year interval or scheduled in a more concentrated manner that economizes on verification expenses. Forest Owners may be notified of a site-visit verification prior to the year in which the verification is to take place.

The only exception is when a second site-visit verification for a Reforestation Project is deferred for more than six years. In this case, the calculation of the percentages for meeting the six-year and twelve-year minimums may be made by excluding the deferred Reforestation Projects from the totals. After the second site-visit verification for a Reforestation Project, this exception is no longer allowed.

C.2.10.2 Required Desk Review Verification Schedule for Aggregates

Between site-visit verifications, each Forest Owner must submit annual project monitoring reports. Verification bodies must annually audit a sample of the annual monitoring reports,

equivalent to the square root of the total number of participating projects in the aggregate, or the total number of participating projects divided by 12, whichever is higher (when rounded to the next highest whole number). As an example, an aggregate with 16 projects must have four project monitoring reports verified in a given year. Audited projects must be selected randomly, and must not include projects undergoing site-visit verification for the year. Forest Owners will not know when their annual monitoring reports will require verification. Since this is a random process, a Forest Owner may have the annual report verified in consecutive years or not until the project is verified with a required site visit.
Successful verification of a representative sample results in the crediting of all projects participating in the entire aggregate. If verification for a participating project is unsuccessful, the verification body must verify additional participating projects until the total number of successful verifications reaches the required number (as described above). If the required number of successful verifications has not been achieved within 12 months after the date the verification body submits a negative Verification Opinion and Report to the approved offset project registry for a project in the aggregate, crediting of all the participant projects in the aggregate will be suspended until the required number of successful verifications has been achieved.

If material issues arise during verification of a participant project, the Forest Owner will need to independently address the issues and required corrective actions using the same process taken with standalone projects.

Ecology will not issue offset credits for a project in an aggregate that received an adverse verification statement, per WAC 173-446-555 (1)(c)

Aggregators may assist the Forest Owner in preparing documents for verification and facilitate the verification process. The scope of these services is determined by the specific contract between the Forest Owner and the Aggregator. The ultimate responsibility for monitoring reports and verification compliance is assigned to each participating Forest Owner.