CLIMATE ACTION RESERVE

Urban Tree Planting Project Protocol

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Abbreviations and Acronyms

C	Carbon
CAL FIRE	California Department of Forestry and Fire Protection
CH_4	Methane
CO_2	Carbon dioxide
CRT	Climate Reserve Tonne
DBH	Diameter at Breast Height
FIA	Forest Inventory and Analysis Program of the U.S. Forest Service
GHG	Greenhouse gas
GIS	Geographical Information System
ISO	International Organization for Standardization
N_2O	Nitrous oxide
PDD	Project Design Document
PIA	Project Implementation Agreement
Reserve	Climate Action Reserve
RPF	Registered Professional Forester (California only)
SSR	Source, sink, or reservoir
UFM	Urban forest management
USFS	United States Forest Service
UTP	Urban tree planting
VOC	Volatile Organic Compound

1 Introduction

This Urban Tree Planting (UTP) Project Protocol provides requirements and guidance for quantifying the net climate benefits of activities that sequester carbon in woody biomass within an urban environment. The protocol provides: project eligibility rules; methods to calculate a project's net effects on greenhouse gas (GHG) emissions and removals of CO_2 from the atmosphere ("removals"); procedures for assessing the risk that carbon sequestered by a project may be reversed (i.e. released back to the atmosphere); and approaches for long term project monitoring and reporting.

The goal of this protocol is to ensure that the net GHG reductions and removals caused by a project are accounted for in a complete, consistent, transparent, accurate, and conservative manner[1] and may therefore be reported to the Climate Action Reserve (Reserve) as the basis for issuing carbon offset credits (called Climate Reserve Tonnes, or CRTs). Additionally, it is the goal of the Reserve to ensure the protocol is as efficient and practical as possible for Project Operators.

As the premier carbon offset registry for the North American carbon market, the Reserve encourages action to reduce greenhouse gas (GHG) emissions by ensuring the environmental integrity and financial benefit of emissions reduction projects. The Reserve establishes high quality standards for carbon offset projects, oversees independent third-party verification bodies, issues carbon credits generated from such projects and tracks the transaction of credits over time in a transparent, publicly-accessible system. The Climate Action Reserve is a private 501(c)(3) nonprofit organization based in Los Angeles, California.[2]

Only those projects that are eligible under and comply with this UTP Project Protocol may be registered with the Reserve. Section 8 of this protocol provides requirements and guidance for verifying the performance of project activities and their associated GHG reductions and removals reported to the Reserve.

1.1 About Urban Forests, Carbon Dioxide and Climate Change

Urban forests have the capacity to both emit and absorb carbon dioxide (CO_2), a leading greenhouse gas that contributes to climate change. Trees, through the process of photosynthesis, naturally absorb CO_2 from the atmosphere and store the gas as carbon in their biomass, i.e. trunk (bole), leaves, branches, and roots. Carbon may also be stored in the soils that support the urban forest, as well as the understory plants and litter on the urban forest floor. After trees are removed, their wood residue may be converted into mulch, with CO_2 gradually released to the atmosphere through decomposition. Carbon may continue to be sequestered for a substantial amount of time in wood products and in landfills. Carbon from urban forests may also be used to provide fuel for biomass energy. Also, urban trees can reduce summertime air temperatures and building energy use for air conditioning, thus reducing GHG emissions from electricity generation (Akbari 2002). In winter, trees can increase or decrease GHG emissions associated with energy consumed for space heating, depending on local climate, site features, and building characteristics (Heisler 1986).

[1] See the WRI/WBCSD GHG Protocol for Project Accounting (Part I, Chapter 4) for a description of GHG reduction project accounting principles.
[2] For more information, please visit www.climateactionreserve.org.

When trees are disturbed, through events like fire, disease, pests, or harvest, some of their stored carbon may oxidize or decay over time, releasing CO_2 into the atmosphere. The quantity and rate of CO_2 that is emitted may vary, depending on the particular circumstances of the disturbance. Depending on how urban forests are managed or impacted by natural events, they can be a net source of emissions, resulting in a decrease to the reservoir, or a net sink, resulting in an increase of CO_2 to the reservoir. In other words, urban forests may have a net negative or net positive impact on the climate.

2 Urban Tree Planting Definition and Requirements

For the purposes of this protocol, an urban tree planting (UTP) project ("Project") is 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 urban forest carbon stocks.

A glossary of terms used in this protocol is provided in Section 9. Throughout the protocol, important defined terms are capitalized (e.g. "Urban Forest Owner").

2.1 Project Definition

A UTP Project is a project where new trees are planted in areas where trees have not been harvested with a primary commercial interest during the 10 years prior to the Project Commencement Date. Only planted trees and trees that regenerate from planted trees are eligible to be quantified for credits. Benefits from urban tree planting activities occur when the net CO_2e (CO_2e stored minus CO_2e emitted) associated with planted trees exceeds baseline tree planting CO_2e levels.

2.2 Urban Forest Owners

Credits for a Project must be quantified from carbon that is owned by participating entities. An Urban Forest Owner is a corporation, a legally constituted entity (such as a utility or special district), city, county, state agency, educational campus, individual(s), or a combination thereof that has legal control of any amount of urban forest carbon[3] within the Project Area.

Only counties, municipalities, educational institutions, and utilities/ special districts may develop a project independently. Other Urban Forest Owners must develop a project as an aggregated project. Aggregated projects may only include the carbon controlled by municipalities, counties, educational institutions, and utilities/special districts by permission as described in Section 2.3. However, counties, municipalities, educational institutions, and utilities may not enroll the same area in both an independent project and an aggregation project. An aggregated project must allow participation by all Urban Forest Owners within the Project Area. No more than one aggregated project can exist within the limits of a Project Area.

Control of urban forest carbon means the Urban Forest Owner has the legal authority to effect changes to urban forest carbon quantities (right to plant or remove, for example). Control of urban forest carbon occurs, for purposes of satisfying this protocol, through fee ownership, perpetual contractual agreements, and/or deeded encumbrances. This protocol recognizes the fee owner as the default owner of urban forest carbon where no explicit legal encumbrance exists. Individuals or entities holding mineral, gas, oil, or similar *de minimis*[4] interests without fee ownership, are precluded from the definition of Urban Forest Owner.

Urban Forest Owners are able to combine, or aggregate, forest carbon with other Urban Forest Owners to develop a project at increased scale. Urban Forest Owners must agree to a single Project Operator (see below) who is designated to manage the requirements of the project.

[3] See definition of Forest Carbon in glossary.
[4] *de minimis* control includes access right or ways and residential power line right of ways.

2.3 Project Operators

A Project Operator must be one of the Urban Forest Owners or a legally created entity to represent the Urban Forest Owners. The Project Operator is responsible for undertaking a UTP Project and registering it with the Reserve, and is ultimately responsible for all project listing, monitoring, reporting and verification. The Project Operator is responsible for any reversals associated with the project and is the entity that executes the Project Implementation Agreement (see below) with the Reserve.

In all cases where multiple Urban Forest Owners participate in a UTP Project, the Project Operator must secure an agreement from all other Urban Forest Owners that assigns authority to the Project Operator to include the carbon they own in the Project, subject to any conditions imposed by any of the Urban Forest Owners to include or disallow any carbon they control and any provisions to opt out of the project.

2.4 Project Implementation Agreement

A Project Implementation Agreement (PIA) is a required agreement between the Reserve and a Project Operator setting forth the Project Operator's obligation (and the obligation of its successors and assigns) to comply with the UTP Project Protocol.

3 Eligibility Rules

In addition to the definitions and requirements described in Section 2, projects must meet several other criteria and conditions to be eligible for registration with the Reserve, and must adhere to the following requirements related to their duration and crediting periods.

3.1 Project Location

Only those activities that occur within the Urban Area boundaries, defined by the most recent publication of the United States Census Bureau (http://www.census.gov/geo/maps-data/maps.html), are eligible to develop a project under this protocol. Projects must be entirely within the Urban Area boundary as of Project Commencement.

3.2 Project Area

The Project Area is the geographic extent of the UTP Project. The Project Area may be made up of consolidated or disaggregated polygons. A KML file must be submitted with the project to clearly identify the project boundaries. There are no size limits for UTP Projects.

3.3 Project Commencement

The commencement date for a Project is the date at which the Project Operator initiates an activity that will lead to increased GHG reductions or removals with long-term security relative to the Project baseline. The commencement date can be as early as August 1, 2008 (the date of the adoption of the Urban Forest Project Protocol Version 1.0 by the Reserve's Board); however no credits can be issued for carbon stored more than two years prior to the Project Submission Date.

The earliest acceptable activity that demonstrates the commencement of project activities is a formal planning process by the Project Operator. Subsequent activities to planning, including the purchase of equipment for tree planting, site preparation, or planting trees, with a plan in place, also demonstrate a project has commenced. Once a UTP Project has commenced, new plantings can occur within the Project Area throughout the Project Life. Discrete and verifiable evidence that acceptable activity has occurred includes signed contracts and/or direct evidence of the recent activity.

3.4 Additionality

The Reserve will only register projects that yield surplus GHG emission reductions and removals that are additional to what would have occurred in the absence of a carbon offset market (i.e. under "Business As Usual"). For a general discussion of the Reserve's approach to determining additionality, see the Reserve's Program Manual (available at http://www.climateactionreserve.org/how/program/program-manual/).

Projects must satisfy the following tests to be considered additional.

3.4.1 Legal Requirement Test

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. 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. Deeded encumbrances, tree-planting and management

ordinances, and contractual agreements, collectively referred to as Legal Agreements, may effectively control urban forest carbon and possess ownership rights to the carbon inventories controlled. Similarly, deeded encumbrances, tree planting and management ordinances, and contractual agreements may have an effect on urban forest carbon inventories beyond the control of any of the Urban Forest Owners.

Trees planted to fulfill a legal requirement are ineligible under this protocol. Legal requirements include any requirement issued by authority of a federal, state, or local jurisdiction to plant trees for any reason.

3.4.2 Performance Test

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.

3.4.2.1 Performance Standard for Urban Tree Planting Projects

The performance standard metrics are based on the averages of data between the 50th and 100th percentiles. The data are based on the following data:

1. For Municipalities/counties: trees per capita.
2. Educational institutions: trees per acre of maintained landscaping.
3. Utilities: trees per ratepayer

Project Operators must include the performance standard level of planting in their baseline calculations as described in Appendix A (Quantification Guidance).

3.5 Project Crediting Period

The crediting period for UTP Projects is 25 years. Projects may be renewed for additional crediting periods with the prospect of incorporating updated technology into the project analysis. The initial baseline can be maintained for the crediting period. While the project can be renewed indefinitely, the baseline must be renewed at the end of the crediting period. Any previously issued credits are respected for the life of the project.

3.6 Minimum Time Commitment

Projects must monitor, report, and undergo verification activities for 100 years following the last credit issued to the project.

3.7 Social and Environmental and Co-Benefits

All Projects will provide climate benefits to the extent in which they generate credits. The ability to achieve additional environmental and social co-benefits depends on consideration of additional factors, some of which are described in this section. Only those projects where public and/or tribal entities participate in direct urban tree management activities (e.g., planting, tree distribution, etc.) are required to include the provisions for social and environmental co-benefits. However, these provisions may serve as suggestions to NGOs and other privately funded projects that may wish to enhance social and environmental co-benefits. Where required, the provisions must be described in the Project Design Document (PDD) and implemented throughout the project life. The Reserve has developed a tree-planting template that outlines elements that need to be addressed and provides important considerations that may be helpful

in decision-making (template pending; will be available on the urban forest webpage[5]). The template provides considerations that will enable verifiers to ensure progress is being achieved over time.

3.7.1 Social Co-Benefits

Projects can create long-term climate benefits as well as providing other social and environmental benefits. Investment in Projects has the potential to improve the quality of life for urban communities in a number of ways. Among other benefits, tree planting projects can improve air quality and reduce storm water runoff, provide shade, and increase property values by creating a more aesthetically pleasing environment. Projects also have the potential to create negative social externalities such as an uneven distribution of project benefits due to an uneven distribution of projects sites throughout a community (e.g. skewed toward more affluent communities).

Table 3.1. Social Co-Benefits of Urban Tree Planting Projects

Social Provisions	Elements to Include in the Project Design Document (PDD)
Equitable distribution of forest resources	Describe how the project will make progress toward achieving relatively equal distribution of tree canopy cover by neighborhood whenever possible.
Public participation	Establish guidelines to ensure adequate notification, opportunities for public participation, and documentation with regards to public activities with urban forest management.

3.7.2 Environmental Co-Benefits

The protocol has a goal of permanently removing greenhouse gases from the atmosphere by sustaining carbon benefits generated from urban forests for at least 100 years. Healthy urban forests can also provide a number of environmental benefits as well as create negative externalities. Projects have the potential to improve air quality and reduce storm water runoff and energy usage. They can also contribute to reduced biodiversity, introduce invasive species, and damage infrastructure. Inefficient water usage during maintenance can also put pressure on local and regional water supplies.

Table 3.2. Environmental Co-Benefits of Urban Tree Planting Projects

Environmental Provisions	Elements to Include in the Project Design Document (PDD)
Biodiversity	Describe how UTP Project activities will maintain and enhance biodiversity, including: 1. Benefits of tree species selection and composition to biodiversity within the project area. 2. Use of specific tree species, sizes and/or distributions to support unique habitat elements.
Native species	Describe how UTP Project activities will promote the use of native species, including:

[5] http://www.climateactionreserve.org/how/protocols/urban-forest/

	1. Strengths and limitations of using native trees in the UTP Project. 2. Preferential treatment of native species.
Non-native species	Describe how UTP Project activities will limit and target the use of any non-native species, including: 1. Strengths and limitations of using non-native trees in the UTP Project. 2. Resistance to insects and disease.
Climate change resilience	Describe how UTP Project activities will enhance the resilience of the urban forest to climate change, including: 1. Ability of urban forest to adapt to climate change. 2. Resistance to natural disturbances.
Air quality	Describe how UTP Project activities will enhance air quality benefits, including: 1. Tree selection and distribution to reduce air pollutants. 2. Tree selection and distribution to reduce emissions of Biogenic Volatile Organic Compounds (BVOCs). 3. Design tree maintenance activities to reduce fossil fuel emissions.
Physical characteristics	Describe how UTP Project activities will enhance physical characteristics of the urban environment, including: 1. Tree shading. 2. Wind protection. 3. Minimize disturbance to city infrastructure (e.g. sidewalks, power lines, etc.)
Water Management	Describe how UTP Project activities will improve water management, including: 1. Increase infiltration and recharge of groundwater. 2. Reduce stormwater runoff. 3. Conserve water from urban forest management.

4 GHG Assessment Boundaries

The quantification of all included sources, sinks, and reservoirs (SSR) (Table 4.1 below) are described in the quantification guidance in Appendix A.

Table 4.1. Description of all Sources, Sinks, and Reservoirs

SSR	Source Description	Type	Gas	Included (I) or Excluded (E)	Justification/Explanation
UF-1	Standing live carbon (carbon in all portions of living trees)	Reservoir / Pool	CO_2	Included	Increases in standing live carbon stocks are likely to be a large Primary Effect of UTP Projects
UF-2	Shrubs and herbaceous understory carbon	Reservoir / Pool	CO_2	Excluded	For crediting purposes shrubs and herbaceous understory are excluded since changes in this reservoir are unlikely to have a significant effect on total quantified GHG reductions or removals. Furthermore, it is generally not practical to undertake measurements of shrubs and herbaceous understory accurate enough for crediting purposes.
UF-3	Standing dead carbon (carbon in all portions of dead, standing trees)	Reservoir / Pool	CO_2	Excluded	Standing dead wood is expected to be a small portion of UTP Projects.
UF-4	Lying dead wood carbon	Reservoir / Pool	CO_2	Excluded	For crediting purposes lying dead wood carbon is excluded since changes in this reservoir are unlikely to have a significant effect on total quantified GHG reductions or removals. Changes associated with carbon projects are likely to increase lying dead wood. Furthermore, it is generally not practical to undertake measurements of lying dead wood accurate enough for crediting purposes.
UF-5	Litter and duff carbon (carbon in dead plant material)	Reservoir / Pool	CO_2	Excluded	Litter and duff carbon is excluded since changes in this reservoir are unlikely to have a significant effect on total quantified GHG reductions or removals. Furthermore, it is generally not practical to undertake measurements of litter and duff accurate enough for crediting purposes.
UF-6	Soil carbon	Reservoir / Pool	CO_2	Excluded	Soil carbon is not anticipated to change significantly as a result of UTP Projects.

SSR	Source Description	Type	Gas	Included (I) or Excluded (E)	Justification/Explanation
UF-7	Carbon in in-use forest products	Reservoir / Pool	CO_2	Excluded	Urban forests do not produce significant levels of wood products that persist for long enough periods of time to meet permanence requirements and UTP Projects will not substantially change wood product production.
UF-8	Forest product carbon in landfills	Reservoir / Pool	CO_2	Excluded	Urban forests do not produce significant levels of wood products and UTP Projects will not substantially change wood product production.
UF-9	Nutrient application	Source	N_2O	Excluded	The use of nitrogen-based fertilizers is not expected to be a significant source of emissions.
UF-10	Biological emissions from site preparation activities	Source	CO_2	Excluded	Biological emissions from site preparation are not quantified since projects that involve intensive site preparation activities are not eligible.
UF-11	Mobile combustion emissions from site preparation activities	Source	CO_2	Excluded	Mobile combustion CO_2 emissions from site preparation are not quantified since projects that involve intensive site preparation activities are not eligible.
			CH_4	Excluded	Changes in CH_4 emissions from mobile combustion associated with site preparation activities are not considered significant.
			N_2O	Excluded	Changes in N_2O emissions from mobile combustion associated with site preparation activities are not considered significant.
UF-12	Mobile combustion emissions from ongoing project operation and maintenance	Source	CO_2	Excluded	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	CH_4 emissions from mobile combustion associated with ongoing project operation and maintenance activities are not considered significant.
			N_2O	Excluded	N_2O emissions from mobile combustion associated with ongoing project operation and maintenance activities are not considered significant.

SSR	Source Description	Type	Gas	Included (I) or Excluded (E)	Justification/Explanation
UF-13	Stationary combustion emissions from ongoing project operation and maintenance	Source	CO_2	Excluded	Stationary combustion CO_2 emissions from ongoing project operation and maintenance could include GHG emissions associated with electricity consumption or heating/cooling at Urban Forest Owner 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	CH_4 emissions from stationary combustion associated with ongoing project operation and maintenance activities are not considered significant.
			N_2O	Excluded	N_2O emissions from stationary combustion associated with ongoing project operation and maintenance activities are not considered significant.

5 Quantifying Net GHG Reductions and Removals

This section provides general requirements and guidance for quantifying a Project's net GHG reductions and removals. Detailed methodological approaches to quantifying GHG reductions and removals are provided in Appendix A (Quantification Guidance). The Reserve will issue Climate Reserve Tonnes (CRTs) to a Project upon confirmation by an ISO-accredited and Reserve-approved verification body that the Project's GHG reductions and removals have been quantified following the applicable requirements of this section (see Section 8 for verification requirements). The Reserve provides an Urban Forest Calculation Tool on its website to assist with the annual calculation of reductions and removals.

Quantification proceeds according to the steps below.

1. **Estimating baseline onsite carbon stocks**. The baseline is an estimate of what would have occurred in the absence of a Project. To establish baseline onsite carbon stocks, the Project Operator must apply the appropriate performance test from Section 3.4.2 of this protocol to the Project Onsite Inventory at Project Commencement. The Project Onsite Inventory must have been developed according to the guidelines established in Appendix A (Quantification Guidance). Baseline estimates are developed for a 100-year period. Generally, baselines do not change during this period absent findings of errors in initial calculation or reconciliation associated with methodological updates.

2. **Determining actual onsite carbon stocks**. Each year, the Project Operator must determine the Project's actual onsite carbon stocks. This must be done by updating the Project's forest carbon inventory for the current year, following the guidance in this section and in Appendix A. The estimate of actual onsite carbon stocks must be adjusted by an appropriate confidence deduction, as described in Appendix A.

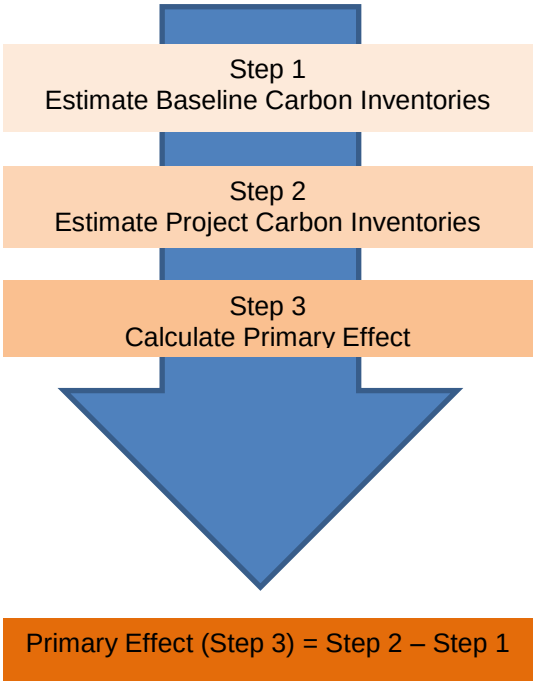
3. **Calculating the project's Primary Effect**. Each year, the Project Operator must quantify the actual change in GHG emissions or removals associated with the Project's intended ("primary") effect. For any given year, the Primary Effect is calculated by:
    a. Taking the difference between actual onsite carbon stocks for the current year and actual onsite carbon stocks for the prior year.[6]
    b. Subtracting from (a) the difference between baseline onsite carbon stocks for the current year and baseline onsite carbon stocks for the prior year.

4. Calculating total net GHG reductions and removals. For each year, total net GHG reductions and removals are calculated by summing a Project's Primary and Secondary Effects. If the result is positive, then the Project has generated GHG reductions and/or removals in the current year. If the result is negative, this may indicate a reversal has occurred (see Section 6).[7]

The required formula for quantifying annual net GHG reductions and removals is presented in Equation 5.1. Net GHG reductions and removals must be quantified and reported in units of carbon dioxide-equivalent (CO_2e) metric tons.

[6] For the purposes of calculating the project's Primary Effect, actual and baseline carbon stocks prior to the Project Commencement Date are assumed to be zero.

[7] A reversal occurs only if: (1) total net GHG reductions and removals for the year are negative; and (2) CRTs have previously been issued to the UTP Project.



Equation 5.1. Annual Net GHG Reductions and Removals

$$\boldsymbol{QR_y} = (\Delta \boldsymbol{AC_{onsite}} - \Delta \boldsymbol{BC_{onsite}})$$

Where,

			Units
QR_y	=	Quantified GHG reductions and removals for year y	tCO_2e
ΔAC_{onsite}	=	$(AC_{onsite, y}) - (AC_{onsite, y-1})$	tCO_2e
	Where,		
		$AC_{onsite, y}$ = Actual carbon (CO_2e) as inventoried for year y (y may be less than a year for the first reporting period following Project Commencement).	tCO_2e
		$AC_{onsite, y-1}$ = Actual carbon (CO_2e) as inventoried for year y-1	tCO_2e
ΔBC_{onsite}	=	$(BC_{onsite, y}) - (BC_{onsite, y-1})$	tCO_2e
	Where,		
		$BC_{onsite, y}$ = Baseline onsite carbon (CO_2e) as estimated for year y (y may be less than a year for the first reporting period following Project Commencement).	tCO_2e
		$BC_{onsite, y-1}$ = Baseline onsite carbon (CO_2e) as estimated for year y-1	tCO_2e

5.1 Urban Forest Protocol Baselines

A key component of determining additionality for a project is identifying a baseline that appropriately represents what emissions would have occurred in absence of the project. The approach to determining baseline is based on standardized rules defined in this section.

5.1.1 Urban Tree Planting Projects

To develop a project baseline for a UTP Project, Project Operators must provide a qualitative characterization of the regulatory framework governing tree planting activities within the Project Area and explain why trees planted as part of the Project are outside of any framework requiring the planting of trees.

Projects use a performance standard value which provides guidance to quantifying baselines. The performance standard value is a value that represents the averages of data between the 50th and 100th percentiles for trees planted annually for classes based on the entity type (county, municipality, educational institution, or utility/special district), the entity's size (population, landscaped area, or ratepayer population), and the entity's geo-political region. Project Operators must match their entity with an urban forest class on the Reserve's urban forest webpage.

The Performance Standard value (pending) is compared to the actual project trees planted and the resulting proportion is calculated in terms of CO_2e to calculate the baseline contribution. The baseline calculation contains provisions for the potential eventuality that the Project Area is saturated with planted trees. The Reserve's Urban Tree Planting calculation tool, available on the Reserve's website (pending), assists Project Operators with the baseline calculation. A more technical description of the quantification guidance to calculating the Urban Tree Planting baseline can be found in Appendix A.

6 Ensuring the Permanence of Credited GHG Reductions and Removals

Changes in urban forest management have the potential to enhance the rate of CO_2 absorption, providing removals, and reducing or eliminating emissions associated with the loss of trees (reductions). Reductions are not possible with UTP Projects. The Reserve requires that credited GHG reductions and removals be effectively "permanent." For UTP Projects, this requirement is met by ensuring that the carbon associated with credited GHG reductions and removals remains stored for at least 100 years.

The Reserve ensures the permanence of GHG reductions and removals through three mechanisms:

1. The requirement for all Project Operators to monitor onsite carbon stocks, submit regular monitoring reports, and submit to regular third-party verification of those reports along with periodic onsite verifications for the duration of the Project Life.
2. The requirement for all Project Operators to sign a Project Implementation Agreement with the Reserve which obligates Project Operators to retire CRTs to compensate for reversals of GHG reductions and removals.
3. The maintenance of a Buffer Pool to provide insurance against reversals of GHG reductions and removals due to unavoidable causes (including natural disturbances such a fires, pest infestations or disease outbreaks).

GHG reductions and removals can be "reversed" if the stored carbon associated with them is released (back) to the atmosphere. Many biological and non-biological agents, both natural and human-induced, can cause reversals. Some of these agents cannot completely be controlled (and are therefore "unavoidable"), such as natural agents like fire, insects, pathogens, drought, and wind.

Other agents can be controlled, such as the human activities like land conversion. Under this protocol, reversals due to controllable agents are considered "avoidable". As described in this section, Project Operators must contribute to the Reserve Buffer Pool to insure against reversals. If the quantified GHG reductions and removals in a given year are negative, and CRTs were issued to the Project in any previous year, the Reserve will consider this to be a reversal regardless of the cause of the decrease.

The Buffer Pool is a holding account for Project CRTs, which is administered by the Reserve. All Projects must contribute a percentage of CRTs to a Buffer Pool any time they are issued CRTs for verified GHG reductions and removals. A project that has an unavoidable reversal will use Buffer Pool CRTs proportionally from all projects that have contributed to the pool to compensate for the reversal. Project Operators do not receive compensation for their contributions to the Buffer Pool.

If a Project experiences an unavoidable reversal of GHG reductions and removals (as defined in Section 6.2.2), the Reserve will retire a number of CRTs from the Buffer Pool equal to the total amount of carbon that was reversed (measured in metric tons of CO_2). The Buffer Pool therefore acts as a general insurance mechanism against unavoidable reversals for all UTP Projects registered with the Reserve. The Reserve may determine to re-distribute CRTs to Project Operators in the future, or modify the amount of contributions to the Buffer Pool, if actual unavoidable reversals fluctuate significantly from the current evaluation of risks.

6.1 Contributions to the Buffer Pool

Projects may be affected by financial risks, management risks, social risks, risks from pollution, and risks from natural disturbances (disease/insects, wildfire, flooding, drought etc.). To compensate for these risks, each project must contribute 6% of their issued CRTs to the Buffer Pool.

6.2 Compensating for Reversals

The Reserve requires that all reversals be compensated through the retirement of CRTs. If a reversal associated with a Project was unavoidable (as defined below), then the Reserve will compensate for the reversal on the Project Operator's behalf by retiring CRTs from the Buffer Pool. If a reversal was avoidable (as defined below) then the Project Operator must compensate for the reversal by surrendering CRTs from its Reserve account.

6.2.1 Avoidable Reversals

An Avoidable Reversal is any reversal that is due to the Project Operator's negligence, gross negligence, or willful intent, including harvesting, development, and harm to the Project Area due to the Project Operator's negligence, gross-negligence or willful intent. Requirements for Avoidable Reversals are as follows:

1. If an Avoidable Reversal has been identified during annual monitoring, the Project Operator must give written notice to the Reserve within thirty days of identifying the reversal. Additionally, if the Reserve determines that an Avoidable Reversal has occurred, it shall deliver written notice to the Project Operator.
2. Within thirty days of receiving the avoidable reversal notice from the Reserve, the Project Operator must provide a written description and explanation of the reversal to the Reserve.
3. Within four months of receiving the avoidable reversal notice, the Project Operator must retire a quantity of CRTs from its Reserve account equal to the size of the reversal in CO_2-equivalent metric tons (i.e. QR_y, as specified in Equation 5.1). In addition:
    a. The retired CRTs must be those that were issued to the Project, or that were issued to other UTP Projects registered with the Reserve.
    b. The retired CRTs must be designated in the Reserve's software system as compensating for the Avoidable Reversal.
4. Within a year of receiving the avoidable reversal notice, the Project Operator must provide the Reserve with a verified estimate of current onsite carbon stocks and the estimated quantity of the Avoidable Reversal.

6.2.2 Unavoidable Reversals

An Unavoidable Reversal is any reversal not due to the Project Operator's negligence, gross negligence or willful intent, including, but not limited to, wildfires or disease that are not the result of the Project Operator's negligence, gross negligence or willful intent. Requirements for Unavoidable Reversals are as follows:

1. If the Project Operator determines there has been an Unavoidable Reversal, it must notify the Reserve in writing of the Unavoidable Reversal within six months of its occurrence.
2. The Project Operator must explain the nature of the Unavoidable Reversal and provide a verified estimate of onsite carbon stocks within one year so that the reversal can be quantified (in units of CO_2-equivalent metric tons).

If the Reserve determines that there has been an Unavoidable Reversal, it will retire a quantity of CRTs from the Buffer Pool equal to size of the reversal in CO_2-equivalent metric tons.

6.3 Disposition of Projects after a Reversal

If a reversal lowers the UTP Project's carbon stocks below its approved baseline carbon stocks, the Project will be terminated as the original baseline approved for the project would no longer be valid. If a Project is terminated due to an Unavoidable Reversal, a new project may be initiated and submitted to the Reserve for registration on the same Project Area. New projects may not be initiated on the same Project Area if the Project is terminated due to an Avoidable Reversal.

7 Project Monitoring, Reporting, and Verification

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

7.1 Project Documentation

Project Operators must provide the following documentation to the Reserve in order to register a UTP Project.

Table 7.1. Project Documentation Submittal Requirements

Document	When Submitted/Required
Project Submittal Form	Once, at project initiation when the Project Operator wishes to submit project concept to Reserve. Must be submitted within 6 months of the Commencement Date.
Project Design Document	Once, prior to initial verification.
Signed Attestation of Title Form	Prior to issuance of credits. Required at initial verification, onsite verification, and every optional desktop verification.
Signed Attestation of Regulatory Compliance Form	Prior to issuance of credits. Required at initial verification, onsite verification, and every optional desktop verification.
Signed Attestation of Voluntary Implementation Form	Once, prior to the issuance of credits as part of the initial verification.
Verification Report	Upon completion of verification and prior to issuance of credits. Required at initial verification, onsite verification, and every optional desktop verification.
Verification Statement	Upon completion of verification and prior to issuance of credits. Required at initial verification, onsite verification, and every optional desktop verification.
Project Implementation Agreement	Upon completion of verification and prior to issuance of credits. Required at initial verification, onsite verification, and every optional desktop verification.

Project submittal forms can be found at http://www.climateactionreserve.org/how/program/documents/.

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

All projects shall submit a shapefile as a KML that matches the maps submitted to depict the Project Area. The project's reported acres shall be based on the shapefile submitted to the

Reserve. The Reserve will create a file of all verified forest carbon projects on Google Maps for public dissemination.

7.1.1 Urban Forest Project Design Document

The Urban Forest Project Design Document (PDD) is a required document for reporting information about a project. The document is submitted at the initial verification. A PDD template has been prepared by the Reserve and is available on the Reserve's website (pending). The template is arranged to assist in ensuring that all requirements of the UTP Project Protocol are addressed. The template is required to be used by all projects. The template is designed to manage the varying requirements based on project type.

Each project must submit a PDD at the project's first verification. PDDs are intended to serve as the main project document that thoroughly describes how the project meets eligibility requirements, discusses summaries associated with developing data according to quantification requirements, outlines how the project complies with terms for additionality and describes how project reversal risks are calculated. All methodologies used by Project Operators and descriptions in the PDD must be clear in a way that facilitates review by verifiers, Reserve staff, and the public. PDDs must be of professional quality and free of incorrect citations, missing pages, incorrect project references, etc.

7.2 Monitoring Report

Monitoring is the process of regularly collecting and reporting data related to a project's performance. Annual monitoring of UTP 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 7.2. Monitoring is required for a period of 100 years following the final issuance of CRTs to a project for quantified GHG reductions or removals.

Monitoring activities consist primarily of updating a project's forest carbon inventory, entering the updated inventory into the Project's calculation worksheet, and submitting it to the Reserve at frequencies defined in Section 7.3. CRTs are only issued in years that the project data are verified, as described in Section 7.4.

A monitoring report must be prepared for each Reporting Period. Monitoring reports must be provided to verification bodies whenever a Project undergoes verification. Monitoring reports must include an update of the project's calculation worksheet. The project's calculation worksheet includes:

1. An updated estimate of the current year's carbon stocks in the reported carbon pools. Acceptable methodologies for updating the project's inventory are provided in Appendix A (Quantification Guidance). The update 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 removals and/or disturbances that have occurred during the Reporting Period.
2. The baseline carbon stock estimates for the current year, as determined following the requirements in Section 5 and approved at the time of the project's registration.
3. A preliminary calculation of total net GHG reductions and removals (or reversals) for the year, following the requirements in Section 5.

4. *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 Reserve as part of a monitoring report.

Conditional reporting, as pertinent:

1. If a reversal has occurred during the previous year, the report must provide a written description and explanation of the reversal, whether the Reserve classified the reversal as Avoidable or Unavoidable, and the status of compensation for the reversal.

7.3 Reporting and Verification Cycles

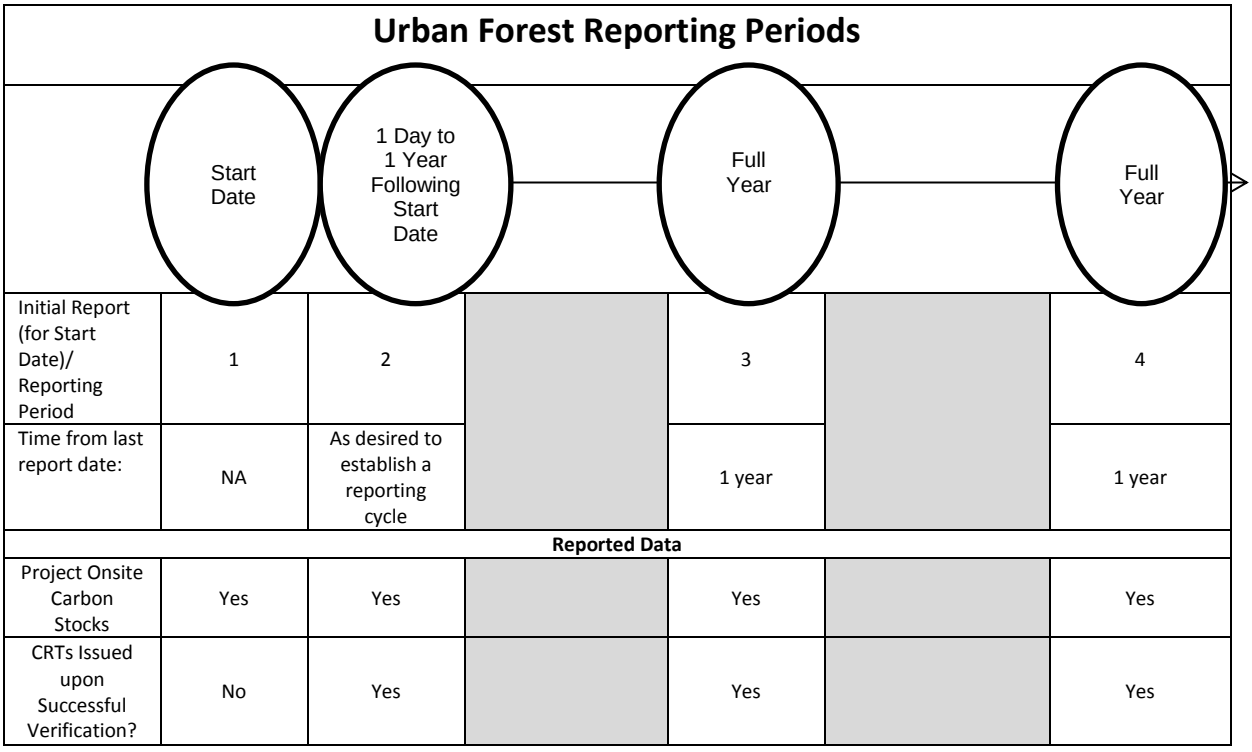
This section describes the required reporting and verification cycles. A Project is considered automatically terminated (see Section 6.3) if the Project Operator chooses not to report data and undergo verification at required intervals.

7.3.1 Reporting Period Duration and Cycles

Projects must report their initial inventory data associated with the Project Commencement Date. Project Operators must report their project inventories annually with the exception of the reporting period immediately following Project Commencement, which can be any length of time up to one year. This enables Project Operators to establish an annual reporting cycle that is convenient for the entity.

Figure 7.1 displays the Reporting Periods in graphical form.

Reporting Periods must be contiguous, i.e. there must be no gaps in reporting during the crediting period of a Project once the first reporting period has commenced.



Initial Report (for Start Date)/ Reporting Period	1	2		3		4
Time from last report date:	NA	As desired to establish a reporting cycle		1 year		1 year
Reported Data						
Project Onsite Carbon Stocks	Yes	Yes		Yes		Yes
CRTs Issued upon Successful Verification?	No	Yes		Yes		Yes

Figure 7.1. Urban Tree Planting Reporting Periods

7.3.2 Verification Cycles

All Projects must be initially verified within 30 months of being submitted to the Reserve. The initial verification of all project types must include a site visit, confirm the project's eligibility, and confirm that the project's initial inventory and the baseline have been established in conformance with the UTP Project Protocol. Subsequent verification may include multiple Reporting Periods and is referred to as the "Verification Period." The end date of any Verification Period must correspond to the end date of a Reporting Period.

Verification has both required frequencies and optional frequencies. Required verification is established on a temporal framework to ensure that ongoing monitoring of urban forest carbon stocks are accurate and up-to-date. Optional verification is at the Project Operator's discretion and may be conducted in the years in which verification is not required and the Project Operator wishes to receive credits. Required verifications are referred to as onsite verifications. Optional verifications are referred to as desk review verifications. Details of verification scheduling requirements are provided within this section.

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 12 month time period will result in account activities being suspended until the verification is complete. 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.

7.3.3 Requirements of Onsite Verifications

Onsite verification is a verification in which project inventory data are verified through a process that audits data in the office as well as data in the field. The Reserve requires that an approved third-party verification body verify all reported data and information for a Project and conduct a site visit for the Verification Period that coincides with Project Commencement and the end of every fifth reporting period following the Project Commencement Date. Buffer Pool contributions are also verified during onsite verifications.

7.3.4 Desk Review Verification

In between onsite verifications, the Project Operator may choose to have an approved third-party verification body conduct a desk review of annual monitoring reports as an optional verification. CRTs may be issued for GHG reductions/removals verified through such desk reviews.

Submission of annual monitoring reports to the Reserve is required even if the Project Operator chooses to forego desk review verification.

7.4 Issuance and Vintage of CRTs

The Reserve will issue Climate Reserve Tonnes (CRTs) for quantified GHG reductions and removals that have been verified through either onsite verifications or desk reviews. Onsite verification may determine that earlier desk reviews overestimated onsite carbon stocks. Any resulting downward adjustment to carbon stock estimates will be treated as a reversal (see Section 6). In this case, the Project Operator must retire CRTs in accordance with the requirements for compensating for a reversal (Section 6.2). Vintages are assigned to CRTs based on the proportion of days in a calendar year within a reporting period.

7.5 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 of CRTs from the Reserve. This information may be requested by the verification body or the Reserve at any time.

7.6 Transparency

The Reserve requires data transparency for all 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 Reserve will be publicly available on the Reserve's website.

8 Verification Guidance

This section provides guidance to Reserve-approved verification bodies for verifying GHG emission reductions associated with urban forest projects.

This section supplements the Reserve's Verification Program Manual,[8] which provides verification bodies with the general requirements for a standardized approach for independent and rigorous verification of GHG emission reductions and removals. The Verification Program Manual outlines the verification process, requirements for conducting verification, conflict of interest and confidentiality provisions, core verification activities, content of the verification report, and dispute resolution processes. In addition, the Verification Program Manual explains the basic verification principles of ISO 14064-3:2006 which must be adhered to by the verification body.

Verification bodies must read and be familiar with the following International Organization for Standardization (ISO) and Reserve documents and reporting tools:

- Urban Tree Planting Project Protocol (this document)
- Reserve Program Manual
- Reserve Verification Program Manual
- Reserve software
- ISO 14064-3:2006 Principles and Requirements for Verifying GHG Inventories and Projects

Only Reserve-approved urban forest project verification bodies are eligible to verify UTP Project reports. To become a recognized urban forest project verifier, verification bodies must become accredited under ISO 14065. Information on the accreditation process can be found on the Reserve website at http://www.climateactionreserve.org/how/verification/how-to-become-a-verifier/.

The verification of reports that reference carbon stocks must be conducted with the oversight of a Certified Arborist, a Professional Forester, or a Certified Forester,[9] managed by the Society of American Foresters, so that professional standards and project quality are maintained. Any Certified Arborist, Professional Forester or Certified Forester who is not currently working with urban forest activities within the Project Area must consult with a Certified Arborist, a Professional Forester, Certified Forester, or planning agency familiar with the practice of urban forestry in that jurisdiction to understand all laws and regulations that govern urban forest practice within the jurisdiction. The Reserve may evaluate and approve alternative professional credentialing requirements if requested, but only for jurisdictions where laws or regulations that govern professional urban forest management do not exist.

8.1 Standard of Verification

The Reserve's standard of verification for UTP Projects is the Urban Tree Planting (UTP) Project Protocol, the Reserve Program Manual, and the Reserve Verification Program Manual. To verify a Project Operator's initial Project Design Document and annual monitoring reports, verification bodies apply the verification guidance in the Reserve's Verification Program Manual

[8] Found on the Reserve website at http://www.climateactionreserve.org/how/program/program-manual/.
[9] See www.certifiedforester.org.

and this section of the UTP Project Protocol to the requirements and guidance described in Sections 2 through 7 of the UTP Project Protocol.

This section of the protocol provides requirements and guidance for the verification of UTP Projects. This section describes the core verification activities and criteria that must be undertaken and addressed by a verification body in order 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 a reasonable assurance that the data submitted on behalf of the Project Operator to the Reserve addresses each requirement in the UTP Project Protocol, Sections 2 through 7. Project reporting is deemed accurate and correct if the Project Operator is in compliance with Sections 2 through 7.

Further information about the Reserve's principles of verification, levels of assurance, and materiality thresholds can be found in the Reserve's Verification Program Manual at http://www.climateactionreserve.org/how/program/program-manual/.

8.2 Project Verification Activities

Required verification activities for UTP Projects vary depending on whether the verification body is conducting an initial verification for registration on the Reserve, onsite verification, or an optional annual verification involving a desk review. The following sections contain guidance for all of these verification activities.

8.2.1 Initial Verification

Verifiers must ensure that the project has met the UTP Project Protocol criteria and requirements for eligibility, Project Area definition, additionality, quantification and calculation of baseline. The initial verification must include onsite verification. The verification body must assess and ensure the completeness and accuracy of all required reporting elements submitted in the Urban Forest Project Design Document.

8.2.2 Onsite Verification

Onsite verification involves review of the Project's quantification, relevant attestations, soil carbon emissions associated with management activities, adherence to environmental and social safeguards (if applicable), and risk of reversal ratings. After a Project's initial verification, subsequent site visits must assess and assure accuracy in measurement and monitoring techniques and onsite record keeping practices. Onsite verifications must be completed during the initial verification and for every fifth subsequent reporting cycle. That is, onsite verification is required every 5-years.

8.2.3 Optional Annual Verification

Optional Annual Verifications can occur according to preferences of the Project Operator. Credits can be verified and registered as the result of an Optional Annual Verification. Optional annual verification occurs in the interim years between onsite verifications. The main focus of optional annual verifications is to assure that Annual Monitoring Reports are complete and that reported project carbon inventories are within acceptable bounds, as described in the Appendix A.

Table 8.1 displays the protocol sections that are verified at the initial verification, the onsite verification, and/or the optional annual verification.

Table 8.1. Verification Items and Related Schedules

Verification Items	Section of UTP Project Protocol	Initial	Site	Optional	Apply Professional Judgment?
1. Project Definition	2.1 Urban Tree Planting	X			Yes
2. Urban Forest Owner	2.2 Urban Forest Owners	X	X		Yes
3. Project Operator	2.3 Project Operators	X	X		No
4. Project Implementation Agreement	2.4 Project Implementation Agreement	X	X	X	No
5. Project Location	3.1 Project Location	X			No
6. Project Area	3.2 Project Area	X			No
8. Project Commencement	3.3 Project Commencement	X			Yes
9. Additionality	3.4.1 Legal Requirement Test 3.4.2 Performance Test	X	X		Yes
	3.4.2.1 Performance Standard for Urban Tree Planting Projects	X			
10.Project Crediting Period	3.5 Project Crediting Period	X	X		No
11.Minimum Time Commitment	3.6 Minimum Time Commitment	X	X		No
12. Social and Environmental Co-Benefits	3.7 Social and Environmental Co-Benefits	X	X		Yes for public entities only
13. Social Co-Benefits	3.7.1 Social Co-Benefits	X	X		Yes for public entities only
14. Environmental Co-Benefits	3.7.2 Environmental Co-Benefits	X	X		Yes for public entities only
15. GHG Assessment Boundaries	4 GHG Assessment Boundaries	X	X		No
The verification topics below are linked to quantification requirements. The verification of project inventories is described in detail below this table. Verifiers shall assure that requirements associated with the references in this table have been satisfied and implement the specific guidance requirements for verifying inventories below.					
16. Quantifying Net GHG Reductions and Removals	5 Quantifying Net GHG Reductions and Removals 8.3 Verifying Carbon Inventories Appendix A Urban Forest Quantification Guidance	X	X	X	No
17. Urban Forest Protocol Baselines	5.1.1 Urban Tree Planting Projects A.2.2 Baseline Development for Urban Tree Planting Projects	X			No
18. Permanence and Buffer Pool Contributions	6.1 Contributions to the Buffer Pool	X	X		No
19. Permanence and Compensating for Reversals	6.2 Compensating for Reversals 6.2.1 Avoidable Reversals 6.2.2 Unavoidable Reversals	X	X	X	No

8.3 Verifying Carbon Inventories

Verification bodies are required to verify carbon stock inventory calculations of all sampled and/or measured 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. The method of verification of carbon inventories varies depending on whether the verification is part of the initial verification, onsite verification, or an optional verification. The verification elements and their periodicity are explained in this section.

Verification Item	Item Description	Frequency of Verification
1 – Quantification of Carbon Estimates	Confirming that the methodology and requirements for quantifying carbon estimates specified in Appendix A were implemented correctly and that the field measurements, use of biomass equations, and summary of project data meet minimum tolerance standards for accuracy, as part of onsite verification.	Initial onsite verification and every subsequent 5 years following initial onsite verification.
2 – Updated Data	Confirming that updated data are within acceptable bounds.	Optional, in years in between onsite verifications.

8.3.1 Verification of Urban Tree Planting Project Inventories

8.3.1.1 Office-based Inventory Verification Activities

The verifier must progress through each successive step according to the guidance below. Verification activities may only proceed to field verification activities once the following items have been successfully verified:

1. Prior to verification of project inventories, **items 1 – 16** in Table 8.1 must be reviewed and deemed satisfactory by the verifier, both in terms of clear presentation and aligned with the protocol requirements.
2. Confirm that the **tree records** used in producing the project-level estimate of CO_2e are in a database, have latitude and longitude for each tree, and that the sum of individual CO_2e estimates for each tree equals the reported value for the project.
3. Confirm that the **confidence statistics** for canopy cover were correctly calculated and meet minimum requirements.

8.3.1.2 Field-Based Inventory Verification Activities

The verification effort must include a re-measurement of a subset of project data used to calculate the inventory estimate for the project. The data sampled by verifiers are individual trees. The verification strategy for all measured data is based on a comparison of randomly selected verifier measurements to Project Operator measurements in a process referred to as sequential sampling. Individual diameters (DBH) and total height must be measured for each tree. The minimum standards of measurement for verifiers are:

1. To the nearest inch for DBH measurements. DBH must be measured per Section A.2.
2. To the nearest foot for height measurements.

Verification using the sequential sampling methodology requires the verification body to sequentially sample 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 according to the tolerance thresholds established in the sequential sampling workbook. The evaluation of the three themes that utilize sequential sampling (CO_2e estimates from plots, current tree canopy area, and historical tree canopy area) shall utilize separate worksheets and include a copy of the results within the verification report.

Where sequential measurements from the verifier result in a trend of agreement with the Project Operator's data, as defined by established tolerance bounds, verification can proceed toward a finding of adequate accuracy. The number of trees measured by the verifier is based on stopping rules established by the Reserve. Where a high level of agreement is found between the Project Operator and the verifier, a finding of accuracy may be established with the minimal number of trees required by the Reserve. As variation between verifier estimates and Project Operators increases, the number of trees measured by the verifier must increase in order to work toward establishing a finding of accuracy. In cases where continued verifier effort does not result in agreement, the Project Operator must decide whether continued investment in verification effort is justified. Alternatively, verification can be suspended while the Project Operator improves the quality of the inventory and revises related project documentation.

The worksheet provided by the Reserve includes the established stopping rules. Where agreement between the verifier and the Project Operator is within specified tolerance bounds, verification of plot data is successful. For the field-based verification activities, the verifier must randomly select an initial set of 40 individual trees sampled by the Project Operator, maintaining the order of their selection in sequential order (1 – 40).

Verification Element	Description	Verification Frequency
1	**Measurement of Field Data**: The verifier must develop an initial strategy to efficiently visit the first 20 trees (1-20) in the list. The trees to not need to be visited and measured sequentially, but they all need to be visited prior to entering the data in the sequential sampling works. The verifier must measure the individual trees and calculate the CO_2e associated with each tree. The entries of tree summaries into the sequential sampling worksheet provided by the Reserve must be in the same order the trees were randomly selected.	Initial verification and each subsequent 5-year onsite verification.
2	**Data Quality Control**: Confirm that the tree records used in producing the project-level estimate of CO_2e are in a database, have latitude and longitude for each tree, and that the sum of individual CO_2e estimates for each tree equals the reported value for the project.	Initial verification and each subsequent 5-year onsite verification.
3	Confirm that the **confidence statistics** for canopy cover were correctly calculated and meet minimum requirements.	Initial verification and each subsequent 5-year onsite verification.

In the interim years between onsite verifications, OPOs can optionally have project stocks verified and receive credits. Verifiers shall compare current reported data with previously verified data and calculate if the reported data are within acceptable tolerance bounds. Data that are not within tolerance bounds must undergo the requirements for a 5-year onsite verification.

8.4 Completing the Verification Process

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

1. Complete a Verification Report to be delivered to the Project Operator (public document).
2. Complete a detailed List of Findings containing both immaterial and material findings (if any), and deliver it to the Project Operator (private document).
3. Prepare a concise Verification Statement detailing the vintage and the number of CRTs verified, and deliver it to the Project Operator (public document).
4. Verify that the number of CRTs specified in the Verification Report and Statement match the number entered into the Reserve software.
5. Conduct an exit meeting with the Project Operator to discuss the Verification Report, List of Findings, and Verification Statement and determine if material misstatements (if any) can be corrected. If so, the verification body and Project Operator should schedule a second set of verification activities after the Project Operator has revised the project submission.
6. If a reasonable level of assurance opinion is successfully obtained, upload electronic copies of the Verification Report, List of Findings, Verification Statement, and Verification Activity Log into the Reserve.
7. Return important records and documents to the Project Operator for retention.

The recommended content for the Verification Report, List of Findings, and Verification Statement can be found in the Reserve's Verification Program Manual.[10] The Verification Program Manual also provides further guidance on quality assurance, negative verification statements, use of an optional Project Verification Activity Log, goals for exit meetings, dispute resolution, and record keeping.

[10] Available at http://www.climateactionreserve.org/how/program/program-manual/.

9 Glossary of Terms

Additionality	GHG emission reductions should occur as a result of specific GHG mitigation incentives; additionality is achieved when GHG reductions are beyond what would occur under business as usual operation and result from activities that are not mandated by regulation.
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 below ground root volume to be estimated using the above-ground bole volume.
Avoidable Reversal	An avoidable reversal is any reversal that is due to the project operator's negligence, gross negligence, or willful intent, including harvesting, development, and harm to the project area.
Baseline	An estimate of GHG emissions and removals that would have occurred in absence of the project under business as usual operations.
Best Management Practices	Management practices determined by a state or designated planning agency to be the most effective and practicable means (including technological, economic, and institutional considerations) of controlling point and nonpoint source pollutants at levels compatible with environmental quality goals.[11]
Biological Emissions	For the purposes of the UTP Project Protocol, biological emissions are GHG emissions that are released directly from forest biomass, both live and dead, including forest soils. Biological emissions are deemed to occur when the reported tonnage of onsite carbon stocks, relative to baseline levels, declines from one year to the next.
Biomass	The amount of living matter comprising, in this case, a tree.
Bole	The trunk or main stem of a tree.
Buffer Pool	The buffer pool is a holding account for urban forest project CRTs administered by the Reserve. It is used as a general insurance mechanism against unavoidable reversals for all UTP projects registered with the Reserve.
Business As Usual	The activities, and associated GHG reductions and removals that would have occurred in the project area in the absence of incentives provided by a carbon offset market.

[11] (Helms, 1998)

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 above-ground or belowground biomass or roots, litter, soil, bole, branches and leaves, among others.
Climate Reserve Tonnes (CRT)	One metric ton (tonne) of verified CO_2 equivalent emission reduction or sequestration.
Carbon Sink	A carbon sink is any process, activity or mechanism that removes carbon dioxide from the atmosphere.
Carbon Source	A carbon source is any process or activity that releases carbon dioxide into the atmosphere.
Carbon Stock	A pool of stored carbon. Urban forest carbon stocks include biomass of the project trees. Include living and standing dead vegetation, woody debris and litter, organic matter in the soil, and harvested stocks such as wood for wood products and fuel.
Carbon stock change or Carbon sequestration	The annual incremental change in carbon stocks.
C_{emis}	CO_2 and other GHG emissions from project maintenance activities, for example, due to vehicular or equipment use.
C_{proj}	Project carbon, i.e. carbon stored annually in project trees, reported as CO_2.
CO_2-equivalent (CO_2e)	The quantity of a given GHG multiplied by its total global warming potential. This is the standard unit for comparing the degree of warming which can be caused by different GHGs.
Certified Arborist	Certified Arborist is the rank of a Registered Consulting Arborist (or above), as certified by the International Society of Arboriculture.
Certified Forester	A professional with certified forester credentials managed by the Society of American Foresters (see www.certifiedforester.org). See also, Professional Forester.
Dry weight (DW) biomass	The weight of aboveground tree biomass when dried to 0% moisture content. Also known as oven-dry and bone-dry biomass. Convert from green biomass to dry weight biomass by multiplying by 0.56 for hardwoods or 0.48 for softwoods.
Entity	The individual, organization, agency or corporation that owns, controls, or manages urban trees.
Freshweight or green biomass	The weight of aboveground tree biomass when fresh (or

	green), which includes the moisture present at the time the tree was cut. The moisture content of green timber varies greatly among different species. The Reserve assumes that the moisture content of fresh weight biomass is 30%.
Global Warming Potential (GWP)	Factors used to convert emissions from GHGs other than carbon dioxide to their equivalent carbon dioxide emissions.
Greenhouse gas (GHG)	Greenhouse gases mean carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).
GHG Assessment Boundary	The GHG Assessment Boundary defines all the GHG sources, sinks, and reservoirs that must be accounted for in quantifying a project's GHG reductions and removals.
Inherent uncertainty	The scientific uncertainty associated with calculating carbon stocks and greenhouse gas emissions.
Leakage	According to the Intergovernmental Panel on Climate Change: "the unanticipated decrease or increase in greenhouse gas benefits outside of the project's accounting boundary as a result of project activities."
Permanence	The requirement that GHGs must be permanently reduced or removed from the atmosphere to be credited as carbon offsets. For UTP projects, this requirement is met by ensuring that the carbon associated with credited GHG reductions and removals remains stored for at least 100 years.
Primary Effects	The 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 (UTP 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. An urban tree planting (UTP) project involves new trees being planted in areas where trees have not been harvested with a primary commercial interest over the past 10 years prior to project commencement. This does not include harvesting where the primary concern is for human safety or forest health. Only planted trees and

	trees that regenerate from planted trees are eligible to be quantified for credits. Benefits from urban tree planting activities occur when the CO_2e associated with planted trees exceeds baseline tree planting CO_2e levels.
Project Activity	The carbon storage, emission reductions and emissions due to an urban tree planting project.
Project Area	The area inscribed by the geographic boundaries of a project.
Project Commencement (Project Commencement Date)	The commencement date is initiated by activities that increase carbon inventories and/or decrease emissions relative to the baseline.
Project Life	Refers to the duration of a project and its associated monitoring and verification activities.
Project Onsite Inventory	The inventory of trees eligible to generate emission reductions or removals in a project. Developed according to the guidelines in Appendix A, Quantification Guidance.
Project Operator	One of the urban forest owners or a legally created entity to represent the urban forest owners that is responsible for undertaking a project.
Project Submission Date	The date that a project is submitted for listing in the Reserve program. The Reserve considers a project to be "submitted" when all of the appropriate forms have been uploaded to the Reserve's software system, and the project operator has paid a project submission fee.
Reporting Uncertainty	The level of uncertainty associated with an entity's chosen method of sampling and/or inventorying carbon stock and calculation methodologies. Contrast with inherent uncertainty.
Reporting Period	The time period for which an entity is reporting its project activity and quantifying GHG reductions. This period will typically be 12 months, except for 1) the initial reporting period which begins at the project commencement date and may be more than 12 months, and 2) the second reporting period, which may be less than 12 months.
Reversal	A reversal is a decrease in the stored carbon stocks associated with quantified GHG reductions and removals that occurs before the end of the project life. Under this protocol, a reversal is deemed to have occurred if there is a decrease in the difference between project and baseline onsite carbon stocks from one year to the next, regardless of the cause of this decrease (i.e. if the result of ($\Delta AC_{onsite} - \Delta BC_{onsite}$) in Equation 5.1 is negative).
Secondary Effects	Unintended changes in carbon stocks, GHG emissions, or GHG removals caused by the project.

Sequestration	The process by which trees remove carbon dioxide from the atmosphere and transform it into biomass.
Start Date	See Project Commencement.
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.[12]
Tree Residue	Aboveground biomass from urban trees (as distinguished from construction debris) that can be salvaged for reuse, such as mulch, wood products, or fuel for biomass power plant.
Unavoidable Reversal	An unavoidable reversal is any reversal not due to the project operator's negligence, gross negligence or willful intent, including windstorms or disease that are not the result of the project operator's negligence, gross negligence or willful intent.
Urban Area	The most recent Urbanized Area definition provided by the United States Census Bureau at http://www.census.gov/geo/maps-data/maps/2010ua.html.
Urban Forest Owner	A corporation, legally constituted entity (such as a utility), city, county, state agency, individual(s), or combination thereof that has legal control (e.g. right to plant or remove, etc.) of any amount of urban forest carbon within the project area.
Verification	The process of reviewing and assessing all of a project's reported data and information by an ISO-accredited and Reserve-approved verification body, to confirm that the project operator has adhered to the requirements of this protocol.
Verification Cycle	The Reserve requires onsite verification of projects every five years, but project operators can choose to have more frequent 'desktop' verifications. In between site visits, desk reviews of project reports can be completed by an approved verification body. The Reserve will only issue CRTs for verified emission reductions.
Verification Period	The period of time over which GHG reductions/removals are verified. A verification period may cover multiple reporting periods. The end date of any verification period must correspond to the end date of a reporting period.

[12] (Helms 1998)

Appendix A Urban Forest Quantification Guidance

This section provides guidance for quantifying a Project's carbon stocks, both for purposes of estimating a project's baseline as well as providing ongoing estimates of project carbon stocks throughout the project life. The quantification portion of this protocol is based on addressing important monitoring requirements. The specific monitoring objectives are to provide estimates of carbon inventories within the Project Area for purposes of calculating credits generated.

The Project Area must be defined prior to initiating inventory activities. Once defined, the Project Area may only be modified through agreement with the Reserve. Modification of the Project Area may impact the baseline, analysis of legal requirements affecting the Project Area and other aspects of UTP Projects.

The quantification guidance is organized into the following sections:

A.1 Reporting Requirements for Urban Forest Carbon Pools

For UTP Projects, only Standing Live and Dead Trees can be included in quantifying project baselines and project estimates.

For standardized reporting, all estimates of forest carbon stocks must be provided in terms of tonnes (metric) 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:

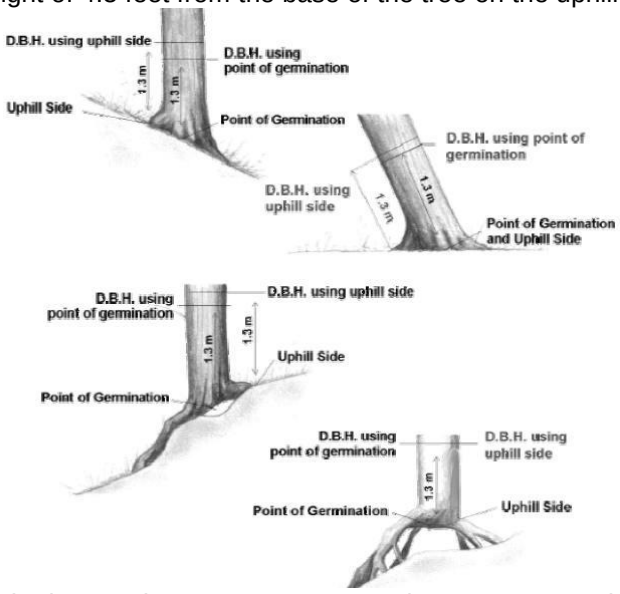
Base Unit	Conversion		Final Unit
Biomass	.5 * biomass	=	Carbon
Carbon	3.67 * carbon		CO_2e
Tons	0.90718474 * tons		Metric Tons (MT) or Tonnes
Hectares	0.404686 * hectares		Acres

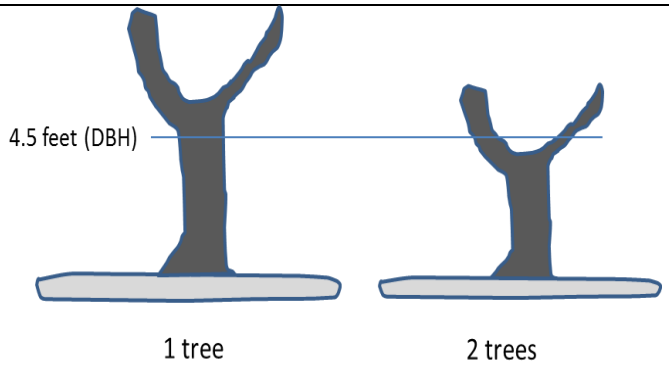
A.2 Methodology for Estimating CO_2e in Urban Tree Planting Projects

Since individual trees planted under UTP Projects are disaggregated and must be identified separately from non-project trees, trees in UTP Projects must be 100% inventoried. Sampling is not allowed for individual UTP Projects. The data required at the time of planting for each tree is identified in Table A.7. These data must be maintained within a database and updated per requirements described within this section.

Table A.1. Measurement Standards for Urban Trees

For Each Tree	
Attribute	**Description**
Date of Tree Visit	Day/Month/Year

Latitude of Tree Center	From GPS	
Longitude of Tree Center	From GPS	
Navigational Feature 1	Description of a resilient feature that can be used to help relocate the tree in the future. Features might include manhole covers, building corners, street signs, etc.	(fire hydrant, street sign, building corner, etc.)
	Distance from feature to the tree	Feet
	Azimuth from feature to the tree	Degrees
Navigation Feature 2	Description of a resilient feature that can be used to help relocate the tree in the future. Features might include manhole covers, building corners, street signs, etc.	(fire hydrant, street sign, building corner, etc.)
	Distance from feature to the tree	Feet
	Azimuth from feature to the tree	Degrees
Urban Forest Class	Enter the Urban Class Code associated with the tree.	
Tree Number	Enter the unique tree number for the tree.	
Inventory Personnel	Enter the initials of the inventory technicians responsible for measuring and recording data for the tree.	
Species	Enter the species code for the tree. The species code can be found for each species in the corresponding reference document on the Reserve's website. The species code is based on the first two letters of the genus and the first two letters of the species for any given species.	
DBH	Measure and record Diameter at Breast Height (DBH) to the nearest inch using a diameter tape and wrapping the tree at a height of 4.5 feet from the base of the tree on the uphill side.  Forked trees above DBH are counted as one tree. Forked trees below DBH are counted as two trees (or however many forked stems exist).	

<table>
<tr><td></td><td> 
</td></tr>
<tr><td>Total Height</td><td>Measure of total height (height from base of tree to top) to the nearest foot.</td></tr>
<tr><td>Growth Condition</td><td>An attribute of ‘Open’ or ‘Closed’ must be assigned to the tree according to the description below:
<table>
<tr><th>Class</th><th>Description</th></tr>
<tr><td>O</td><td>An open attribute is assigned to trees growing in non-natural settings. Tree species may be a variety of native and non-native species. Most often, trees exist in areas where disturbance of natural areas and conversion to another land use has occurred.</td></tr>
<tr><td>C</td><td>A closed attribute is assigned to trees growing in natural settings. Trees present are characteristic of the species diversity and structure in forested areas outside the urban area.</td></tr>
</table></td></tr>
<tr><td>Vigor</td><td>Provide a rating of the tree’s apparent vigor. Determination of vigor based on consideration of color of foliage, crown proportion and appearance, retention of leaves/needles, appearance of apical growth, length between growth whorls, and presence of cavities and fungal growth. The code is assigned based on the following classes:
<table>
<tr><th>Code</th><th>Description*

*based on conditions present during growing periods. Professional judgment need be applied if sampling conducted outside of growing periods.</th></tr>
<tr><td>1</td><td>Excellent – Tree exhibits high level of vigor and no barriers (soil, light, etc.) to continued vigor. No decay or broken branches are observed.</td></tr>
<tr><td>2</td><td>Good - Tree exhibits high level of vigor and some minor barriers (soil, light, etc.) to continued vigor. No decay or broken branches are observed.</td></tr>
<tr><td>3</td><td>Fair – Tree appears generally healthy. Barriers (soil, light, etc.) affect the trees vigor. Tree’s crown may be smaller proportionally than in healthier trees. Decay and/ or broken branches, if observed, are not likely to have negative impacts in the short term.</td></tr>
<tr><td>4</td><td>Poor – Tree appears notably unhealthy, as determined by reduced crown, presence of decay and/or broken branches and/or significant barriers to future growth. Observed problems have high likelihood of being rectified through management of said tree and trees surrounding it.</td></tr>
<tr><td>5</td><td>Critical – Tree appears notably unhealthy, as determined by reduced crown, presence of decay and/or broken branches and/or significant barriers to future growth. Observed problems have low likelihood of being rectified through management of said tree and trees surrounding it.</td></tr>
<tr><td>6</td><td>Dying - Tree is unhealthy. Minimal live crown is present; portions of bark may be missing and/or substantial levels of broken stems and branches. Tree may exhibit advanced decay. No further investment</td></tr>
</table></td></tr>
</table>

		in restoring the tree to a higher vigor is deemed worthwhile.
	7	**Dead-** No live material is observed in the tree.
Defect – Bottom 33%	For each portion of the tree, provide an ocular estimate of the portion of tree that is missing (as a percentage of the section) as the result of breakage or cavities.	
Defect – Mid 33%		
Defect – Top 33%		

A.2.1 Quantification of Carbon in Live Trees from Project Data

All projects must use the appropriate biomass found on the Reserve's Urban Forest Project Protocol webpage, under Resources/Biomass Equations.[13] The biomass equations will enable the calculation of CO_2e in the above-ground portion of trees, using any necessary conversion from volume to carbon and CO_2e described in this section. The below-ground portion of trees shall be estimated as 26% of the above-ground portion of the tree and added to the above-ground portion to calculate an overall estimate for the tree. This calculation shall be included in both the project and baseline accounting.

A.2.2 Baseline Development for Urban Tree Planting Projects

The baseline of UTP Projects is determined using a performance standard statistic. The performance standard statistic is the CO_2e associated with the average of tree planting data between the 50th and 100th percentiles over the past 5 years from entities similar to the project entity. The performance standard statistics are organized by region, by entity class (utility, educational institution, and municipality), and by size of entity. The performance standard statistic can be found on the Urban Forest Project Data link on the Reserve's Urban Forest Project Protocol webpage.[14]

The performance standard statistic number of trees is assumed to continue to be planted on an annual basis and grow. The baseline CO_2e trend is based on the ongoing planting of performance standard trees annually plus growth from trees previously planted. The baseline planting of trees is halted at a time when the Project Operator stops planting project trees, other than replacing dead and dying trees, for a period of 5-years or more. The Project Operator must complete a form indicating the project will not account for any newly planted trees for the minimum 5-year period.

Individual trees are not attributed with a designation of being a performance standard tree. Rather, the performance standard trees are calculated as a percentage of all trees planted and the percentage is applied to the total CO_2e stocks. This removes the threat of bias in estimating the amount of CO_2e associated with the performance standard trees. Figure A.4 below displays an example of baseline and project accounting and displays how removals are calculated.

Project Year	0	1	2	3	4	5	6	7	8	9	10	Notes
Trees Planted in Project Year		350	654	539	-	101	-	-	-	-	-	# trees planted in year-X. Note that no trees were planted in year-4 and that a hiatus occurred in year-6
CO_2e associated with trees planted in project year		14	26	22	-	4	-	-	-	-	-	CO_2e determined by analyzing tree data (for trees planted in year-X) with biomass equations.
Total Project Inventory (CO_2e)	-	14	41	65	69	77	82	87	92	97	103	Sum of CO_2e associated with all trees planted

[13] Forthcoming. http://www.climateactionreserve.org/how/protocols/urban-forest/
[14] Forthcoming. http://www.climateactionreserve.org/how/protocols/urban-forest/

												during project. This is updated annually through inventory updates.
Performance Standard Trees Planted		50	50	50	50	50	-	-	-	-	-	Performance standard, based on entity, size, and region
Baseline Trees as a % of All Trees Planted		14%	10%	10%	13%	15%	15%	15%	15%	15%	15%	The running total of baseline trees compared, as a percentage, to the running total of project trees. Note that baseline trees are arrested when the project entered into hiatus.
Baseline CO_2e (based on CP trees, initial CO_2e, and growth rate)	-	2	4	6	9	12	12	13	14	15	16	The percentage above applied to the total inventory of project CO_2e.
Annual Removals		12	25	22	1	5	4	4	4	5	5	Project(year x) – Baseline(yearx)
Total Removals		12	37	59	60	65	69	73	78	83	87	Sum of Project (all years)-Sum of Baseline (all years)

Figure A.1. Example of the Use of a Performance Standard for Baseline Calculations

The example displays how the performance standard is calculated in terms of a percentage of all trees planted, how that value is interpreted in terms of CO_2e, and the mechanism for calculating annual and total project removals.

A.3 Updating Forest Inventories

Urban forest inventories must be reported to the Reserve on an annual basis. Urban forest inventories are in constant flux due to forest growth and mortality or removal and therefore must be updated on an annual basis for reporting. The inventory must be updated annually through a combination of projecting existing inventory data and/or re-measuring inventory data with an objective of reporting inventory data that reflects actual conditions in the field.

Plot data can be 'grown', or projected for a maximum of 10 years, after which additional field work is required to either update the plot data or establish new plots. In the case of UTP Projects, each tree is considered a plot and, therefore, the tree data can be projected for a period of no more than 10 years before the tree must be re-measured in the field.

It is important to note that the basis of a successful verification depends on alignment (within tolerance bands defined in the verification guidance) between verifier data and Project Operator data for each randomly selected plot (selected by verifier), therefore these guidelines do not ensure successful project verification. The actual timeframe between plot re-measurement may need to be reduced to less than 10 years if the updates of inventory data proof to be inaccurate on a plot by plot basis.

Since the biomass of sampled trees is determined through the use of equations that are based on diameter (breast height) and total height variables, updating plot data for forest growth can be accomplished through the use of projections of inventory data in the database that mimic the diameter and height increment of trees in the field. An additional resource document posted on the urban forest webpage (pending) provides a list of publications that reference urban forest

growth rates. The references in the resource document may be useful for Project Operators in designing an appropriate mechanism to 'grow' their plot data.

Most references address the annual increment of diameter (DBH). Height growth also needs to be addressed to ensure the most accurate comparison of tree records in the database to actual conditions in the field. Heights can be estimated through regression analysis by comparison of measured diameters to measured heights for a given species. It is recommended that, rather than simply relying on the height estimate from the regression analysis, that Project Operators apply the height increment derived from the regression analysis to the height that was measured in the field.

In any case, plot data that is updated to reflect current conditions with the use of predicted increments of height and diameter data, as well as updates for removals, will be used during onsite verifications to compare against verifiers field measurements using the sequential sampling techniques described in the verification section. This provision ensures that plot measurements and update processes are within accuracy thresholds.