URBAN FOREST CARBON REGISTRY

Tree Preservation Protocol

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Urban Forest Carbon Registry, a 501(c)(3) non-profit organization
999 Third Ave. #4600
Seattle, WA 98104
info@ufregistry.org
(206) 623-1823

Drafting Group

Zach Baumer
Climate Program Mgr.
City of Austin

Rich Dolesh
VP Conservation & Parks
National Recreation and Park Association

Heather Sage
Dir. of Community Projects
Pittsburgh Parks Conservancy

Ian Leahy
Dir. of UF Programs
American Forests

Scott Maco
Dir. of Research & Dev.
Davey Institute

Jenny McGarvey
Forest Programs Mgr.
Alliance for Chesapeake Bay

Greg McPherson
Research Scientist
U.S. Forest Service

Mark McPherson
Ex. Dir.
Urban Forest Carbon Registry

Darren Morgan
Manager
Seattle DOT

Walter Passmore
City Forester
City of Palo Alto

Shannon Ramsay
Founder
Trees Forever

Misha Sarkovich
Customer Solutions
Sacramento Municipal Utility District

Skip Swenson
VP
Forterra

Andy Trotter
VP of Field Ops.
West Coast Arborists

Gordon Smith
Ecofor Seattle

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Introduction

This Urban Forest Carbon Protocol sets forth the requirements for Tree Preservation projects in urban areas in the U.S. to quantify carbon dioxide sequestration from woody biomass. That woody biomass is referred to herein by the broader term "urban forest."

This protocol provides eligibility rules, methods for quantifying biomass and CO2 storage, and reporting, monitoring, issuance of credits, reversal, and verification requirements. We have been guided in our drafting by one of the foundational documents for carbon protocols, the WRI/WBCSD GHG Protocol for Project Accounting, which describes GHG project accounting principles.

Our goal is in this protocol is to provide for accounting of net GHG reductions is a consistent, transparent, and accurate manner, consistent with the principles and policies set forth in the WRI GHG Protocol for Project Accounting document. This process will form the basis for GHG reductions that are real, additional, permanent, verifiable, and enforceable, which can then result in the issuance by the Urban Forest Carbon Registry of carbon offset credits, called Community Carbon Credits™ or Community CarbonGreen Credits™.

Urban forests in the U.S. are estimated to store over 643 million tonnes of CO2.[1] The co-benefits of urban forests include air quality improvements, energy savings from reduction of the urban heat island effect, slope stability, bird and wildlife habitat, sound and visual buffering, public health improvements, safety, livability,

[1] Nowak, David J., et al. "Carbon storage and sequestration by trees in urban and community areas of the United States." *Environmental Pollution* 178 (2013): 229-236, 231.

social cohesiveness, economic improvements, and more.[2] Urban trees clearly influence air temperatures and energy and affect local climate, carbon cycles, and climate change.[3]

Moreover, almost 80% of the population worldwide lives in urban areas, and urbanization is a significant demographic trend of the 21st century. The array of benefits delivered by urban trees directly links to human health and life in cities and towns.

Documents and Standards for Protocol Development

No single authoritative body regulates carbon protocols or determines final standards. The Stockholm Environment Institute's Carbon Offset Research and Education resource lists the various institutions and programs that have set out formulations of basic principles that every carbon offset protocol should contain.[4]

CORE lists twenty-five different programs or institutions that have either developed standards for protocols or issued standards and rules for their own programs. These institutions range from international bodies such as the Kyoto Protocol, the World Resources Institute, and the International Organization for Standardization, to U.S. carbon programs such as the Regional Greenhouse Gas Initiative and Midwest Greenhouse Gas Reduction Accord, to registries such as the American Carbon Registry, the Climate Action Reserve, and the Verified Carbon Standard.

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[2] See Alliance for Community Trees, Benefits of Urban Forests: a Research List at http://www.actrees.org/files/Research/benefits_of_trees.pdf

[3] Nowak, 229.

[4] See CORE at http://www.co2offsetresearch.org/policy/ComparisonTableAdditionality.html

The standards issued by these bodies vary, and the specific rules formulated to give content to these different standards vary even more. For example, the Clean Development Mechanism under the UN Framework stemming from the Kyoto Protocol lists 115 different approved baseline and monitoring methodologies for large scale offset projects.

To complicate matters, the environmental and carbon community have tolerated a de facto different standard between compliance protocols and voluntary protocols. Compliance protocols exist in cap and trade jurisdictions like California. Because these compliance protocols establish the rules for credits that will offset actual regulated GHG emissions from monitored sources, greater rigor is expected than in voluntary protocols, where purchasers are buying credits voluntarily to reduce their carbon footprint, not to offset regulated emissions.

There is, nonetheless, a general consensus that all carbon offset protocols must contain the following:

- Accounting Rules: offsets must be "real, additional, and permanent." These rules cover eligibility requirements and usually include baselines for additionality, quantification methodologies, and permanence standards.
- Monitoring, Reporting, Verification Rules: monitoring, reporting, and verification rules ensure that credits are real and verifiable.

Certification, enforceability, and tracking of credits and reversals are performed by specific programs or registries, guided by language in the protocol where relevant.

Over the last fifteen years, several documents setting forth standard and principles for protocols have emerged as consensus leaders for programs attempting to develop their own offset protocols for specific project types. We will follow and refer most often to:

- World Resources Institute/WBCSD GHG Protocol for Project Accounting ("WRI GHG Protocol");
- Clean Development Mechanism, Kyoto Protocol, now part of the UN Framework Convention on Climate Change ("CDM").

We have been guided by the WRI GHG Protocol and have modelled this urban Tree Preservation Protocol after the "avoided conversion" protocols that have been developed for forest land. Further discussion of protocol principles and requirements can be found in Appendix D, a separate document that discusses both the Tree Planting and the Tree Preservation Protocols.

Recognition of Distinct Urban Forest Issues in Protocol Development

The task for the Urban Forest Drafting Group was to take the principles and standards set forth in these foundational documents and adapt them to urban forestry. Urban forestry and its potential carbon projects are different than virtually all other types of carbon projects:

- Urban forests are essentially public goods, producing benefits far beyond the specific piece of land upon which individual trees are planted.
- New tree planting in urban areas is almost universally done by non-profit entities, cities or towns, quasi-governmental bodies like utilities, and private property owners.
- Except for a relatively small number of wood utilization projects, urban trees are not merchantable, are not harvested, and generate no revenue or profit.

- With the exception of very recent plantings begun in California using funds from its Greenhouse Gas Reduction Fund, no one currently plants urban trees with carbon as a decisive reason for doing the planting.
- Because urban tree planting and maintenance are expensive relative to carbon revenues, urban forestry has not attracted established for-profit carbon developers.
- Because urban forest projects will take place in urban areas, they will be highly visible to the public and easily visited by carbon buyers. This contrasts with most carbon projects that are designed to generate tradeable credits purchased in volume by distant and "blind" buyers.

During the drafting process, we remained mindful at all times that the above unique factors of urban forestry distill down to three central attributes:

- Urban trees deliver a broad array of documented environmental and human health benefits,
- Urban trees are essentially a public good delivering their array of environmental benefits to the people and communities living in cities and towns – almost 80% of the population, and
- There are little to no harvests, revenues, or profits for those who preserve and grow the urban forest.

These three key attributes lead to the conclusion that urban forest projects are highly desirable, bringing multiple benefits to 80% of the population in a public good that is unlikely to be gamed or exploited.

Our task then was to draft urban forest protocols that encouraged participation in urban forest projects through highly-credible protocols that addressed not just catch-phrase principles of carbon protocols, but the policies underlying those principles. Where the needs of urban forest practicality required a variance from accepted principles of carbon protocols, we developed solutions to those variances to maintain a high level of stringency.

1. Eligibility Requirements

1.1 Project Operators

A Project requires at least one Project Operator ("PO"), an individual or an entity, who undertakes a Project, registers it with the Urban Forest Carbon Registry (the "Registry"), and is ultimately responsible for the project and its reporting.

1.2 Project Implementation Agreement

A Project Operator must sign a Project Implementation Agreement (PIA) with the Registry setting forth the Project Operator's obligation to comply with this Protocol.

1.3 Project Location

Project Areas must be located within at least one of the following:

A. The Urban Area boundary ("Urban Area"), defined by the most recent publication of the United States Census Bureau (https://www.census.gov/geo/maps-data/maps/2010ua.html);

B. The boundary of any incorporated city or town created under the law of its state;

C. The boundary of any unincorporated city, town, or unincorporated urban area created or designated under the law of its state;

D. A zone or area designated by any governmental entity as a watershed or for source water protection, provided the designated zone or area overlaps some portion of A, B, or C above;

E. A transportation, power transmission, or utility right of way, provided the right of way begins, ends, or passes through some portion of A, B, C, or D above.

1.4 Defining the Project Area

The Project Operator must specify the Project Area and provide an electronic map of the Project Area with geospatial location in any file type that can be imported and read by Google Earth Pro.

The Project Area must be within one of the areas specified in Section 1.3 on Project Location. The Project Area may consist of contiguous or non-contiguous parcels. While it is often convenient for Project Area boundaries to follow land parcel boundaries, Project Area boundaries do not have to follow land parcel boundaries.

Forests naturally have spaces between trees and gaps, and locations of these gaps may change over time. The Project Operator may choose to map gaps in the forest and exclude those non-treed areas from the Project Area. The Project Operator may leave gaps within the Project Area, so long as (a) if the Project Area is in a location that gets at least 20 inches of precipitation per year, tree canopy must cover at least 80% of the entire Project Area, including gaps, or (b) if the Project Area has less than 20 inches of precipitation per year, tree canopy must cover at least 60% of the Project Area, including gaps.

Precipitation may be determined by maps produced by a government agency, or from the average of the most recent ten years of data from the nearest government precipitation measurement station for which data is publicly available. If the Project Operator does not exclude gaps from the Project Area, determination of the carbon stock and sequestration on the Project Area must account for tree canopy gaps.

1.5 Ownership or Eligibility to Receive Potential Credits

The Project Operator must demonstrate ownership of potential credits or eligibility to receive potential credits by meeting at least one of the following:

A. Own the land and potential credits upon which the Project trees are located; or

B. Own an easement or equivalent property interest for a public right of way within which Project trees are located and accept ownership of those Project trees by assuming responsibility for maintenance and liability for them; or

C. Have a written and signed agreement from the landowner committing the landowner to actions, or refraining from actions, required under the Protocol, granting access to Project land to the Project Operator and the Registry to inspect, quantify, or verify data required under this Protocol, and granting ownership to the Project Operator of any credits for carbon storage, other greenhouse gas benefits, and other co-benefits delivered by Project trees on that landowner's land.

2. Project Duration

As set forth in Section 6, the Registry will issue credits based on a 40-year Preservation Commitment (see Section 4.1 for definition of Preservation Commitment). Projects must report throughout their Preservation Commitment. Projects may earn credits after 40 years as provided in Section 8.

3. Project Documentation, Reporting, and Record-keeping

Documentation, reporting, and record-keeping requirements are contained in Appendix A.

4. Demonstrating Preservation and Threat of Loss

To earn credits for Tree Preservation projects (Trees Preserved from Removal), a Project Operator must meet the requirements of Sections 4.1, 4.2, and 4.3:

4.1 That the trees in the Project Area have been preserved as follows (the actions in A and B below are referred to as the "Preservation Commitment"):

A. If the Project Area is privately owned, that the trees are preserved from removal by a recorded easement with a term of at least 40 years. Or,

B. If the Project Area is publicly owned, that the trees are preserved from removal by either:

i. A recorded easement with a term of at least 40 years; or

ii. A management plan or protected status, approved or designated by the governmental body with authority over that land, which preserves the trees in the Project Area from removal for at least 40 years.

And,

4.2 That prior to the Preservation Commitment in Subsection 4.1 above, the project trees were not preserved from removal through easements, management plans, protected status, or other prohibitions on their removal, and

4.3 That prior to the Preservation Commitment in Subsection 4.1 above, the Project Area meet A below and at least one of B, C, or D:

A. Was in a zoning designation that allows for at least one non-forest use (non-forest uses include industrial, commercial, transportation, residential, agricultural, or resource other than forest, as well as non-forest park, recreation, or open space uses), and is not in an overlay zone that prohibits all development; **and at least one of conditions B, C, or D**:

B. Was surrounded on at least 50% of its perimeter by non-forest, developed, or improved uses, including residential, commercial, or industrial; if the Project Area is surrounded by forested land, the 50% perimeter can apply to the surrounding forested land; **or**

C. Had been sold or conveyed or had an assessed value within three years of preservation under Subsection 4.1 for greater than $10,000 average price per acre for the bare land; **or**

D. Would have a fair market value after conversion to a non-forested “highest and best use” greater than the fair market value prior to preservation in subsection 4.1, as stated in a “highest and best use” study from a state certified general real estate appraiser in good standing.

5. Project Commencement

Tree Preservation projects shall commence upon the recording of an easement or adoption of a management plan or protected status preserving trees in the Project Area from removal per subsection 4.1 above, but no earlier than July 1, 2017.

Projects must submit applications to the Registry within one year of its Preservation Commitment.

6. Issuance of Credits for Tree Preservation Projects

The Registry will issue Community Carbon Credits™, representing a tonne of carbon per credit plus other ecosystem benefits.

If the Project Area is less than 20 acres, the Project may quantify CO2 eligible for crediting and request issuance of credits at any time after the Project Commencement date, subject to the provisions below.

If the Project Area is greater than 20 acres and not more than 200 acres, the Project may quantify CO2 eligible for crediting and request issuance of credits attributable to the equivalent of 20 acres of the Project. At each subsequent annual anniversary of the original issuance of credits, the project may request issuance of credits attributable to the equivalent of 20 more acres of the Project, until all attributed credits have been issued, using the most recent verified amount of offsets attributed to the Project.

For example, if the Project Area is 60 acres, the Project Operator would quantify the CO2 eligible for crediting on all 60 acres, and then the Project is eligible to be issued one third of the total number of credits attributed to the project each year for three years (one-third being the equivalent of 20 acres), and with all credits for the project thus issued by the end of the third year.

If the Project Area is greater than 200 acres, the Project may quantify CO2 eligible for crediting and request issuance of credits attributable to the equivalent of 10% of the total credits attributed to the Project. The Project can quantify all CO2 eligible for crediting for the Project Area and request issuance of 10% of the credits each year, until all credits have been issued.

In all Tree Preservation projects, the Registry will issue 90% of credits earned and requested and will hold 10% in the Registry's Reversal Pool. At the end of the Project Duration, if application of approved Registry accounting methods shows that the project is eligible to generate more credits than the Project has been issued, then, (if the Project requests) the Registry will issue to the Project all credits that the Project is eligible to generate that have not yet been issued to the Project. Amounts of credits to be issued under the provisions of this section are gross amounts and include amounts to be issued to both the Project Operator and amounts to be transferred to the Registry's Reversal Pool.

Tree Preservation projects must follow the quantification methods and seek verification per sections 9 and 10.

7. Monitoring

At least once every three years, the Project Operator must observe tree conditions across the Project Area and report these conditions to the Registry. These reports must be in writing, and the Project Operator must attest to the accuracy of the reports. The reports must estimate the percentage of the Project Area that appears to be gaining biomass carbon, the percent of the Project Area that appears to have constant biomass carbon stocks, and the percent of the Project Area that appears to be losing biomass carbon stock. If any area appears to be losing carbon stock, the report shall state the estimated amount of loss. The report shall also estimate the number of acres of significant soil disturbance that has occurred since the previous report. Plowing and removal of topsoil both constitute significant soil disturbance. For the purposes of these reports, areas of soil exposed by trees tipping over are not counted as areas of significant soil disturbance.

8. Reversals in Tree Preservation Projects

Reversals are the loss of biomass carbon ("Loss of Biomass Carbon") after credits have been received by projects but before the expiration of the Preservation Commitment. If there is loss of biomass carbon such that the remaining biomass carbon within the project area may be less than the amount of biomass carbon for which Registry credits have been issued, then the Project must estimate the amount of remaining carbon and report this estimate within 60 days of becoming aware of the loss.

The Registry shall determine, at its own discretion, whether a reversal was the result of intentional action or gross negligence by the Project Operator. If a Reversal was not the result of intentional action or gross negligence, the Registry will replace offsets invalidated by the Reversal with credits from the Registry's Reversal Pool.

If the Registry determines that the Reversal was the result of an intentional action or gross negligence by the Project Operator, the Registry shall estimate the number of remaining creditable tonnes CO2e using whatever estimation methods the Registry deems appropriate. The Registry shall notify the Project Operator of this count. If the Registry determines that more credits have been issued to the Project (counting both credits issued to the Project Operator and credits transferred to the Registry's offset insurance account), the Registry shall notify the Project Operator of this shortfall. The Project Operator shall be responsible for replacing the number of credits that have been issued but that are no longer supported by carbon storage within the Project Area. Within 60 days of being notified of the number of credits that it is obligated to replace, the Project Operator shall submit to the Registry a sufficient number of Urban Forest Carbon Registry credits to cover the shortfall. If the Project Operator is unable to obtain sufficient Urban Forest Carbon Registry credits, the Project Operator may pay the Registry $20 per tonne of shortfall to satisfy the Project Operator's reversal obligation.

Quantifications of carbon stocks determined by the Registry shall be considered to be verified amounts.

If the Project Operator disputes the Registry's reversal calculation, the Project Operator may, at its own expense, measure the remaining carbon stocks within the Project Area that may be more accurate than estimates made by the Registry. The Registry shall consider carbon stock counts submitted to it by the Project Operator, and if the Registry finds that the Project Operator's count is likely to be more accurate than the Registry's estimate, the Registry shall use the Project Operator's count of carbon stocks to determine the Project Operator's liability for replacing credits that are no longer supported by carbon storage within the Project Area.

If a Project has had its carbon stock go below the carbon stock necessary to support offset credits issued by the Registry, no further credits will be issued to the Project until the carbon stocks are above the amounts needed to support issued credits, including credits allocated to the Registry's offset insurance account.

If a Project Operator fails to compensate for a reversal, that Operator may be barred from urban forest projects for a specified time period at the discretion of the Registry.

The above provisions may be set forth in a Project Implementation Agreement between the Project Operator and the Registry.

9. Continuation of Tree Preservation Projects after 40-Year Project Duration

After a 40-year Preservation Commitment, Tree Preservation projects may continue their activities, submit Project Reports under Appendix A, and seek issuance of credits under Section 6. Projects must comply with all applicable requirements of this Protocol.

10. Quantification for Credits

The Registry will issue Community Carbon Credits™ to a Project only after quantification by a Project Operator, verification by the Registry, and a request for issuance of credits by a Project Operator. Project Operators must follow the following Quantification methods.

There are five steps in the quantification of credits generated by the Project:

1. Estimate the biomass stock present, and adjust for uncertainty in the estimate to calculate the "Accounting Stock" (Section 10.1)

2. Calculate the fraction of the Accounting Stock that likely would be emitted as a result of development, to calculate "Avoided Biomass Emissions" (Section 10.2)

3. The Project Operator may elect to also account for growth of trees within the project area, or may choose not to count growth (Section 10.3)

4. Calculate "Avoided Soil Carbon Emissions" (Section 10.4)

5. Calculate the number of credits generated by the Project by either (a) demonstrating that development displaced by the project can be accommodated by redevelopment of existing developed or developable parcels within the urban area, or (b) calculate a deduction in avoided emissions to account for emissions resulting from the Project displacing new development to outside the Project Area (Section 10.5)

10.1 Quantifying Biomass Carbon Stock Present Within the Project Area

Acceptable ways of quantifying the biomass carbon stock present within the Project Area include:

A. The afforestation table from the US Forest Service General Technical Report (GTR) NE-343 appropriate to the geographic area and species, "total nonsoil" carbon stock for stands of the age of the forest on the Project Area. If this method is used, the Project Area must be assessed and divided into stands as by the species grouping in the relevant geographic area in GTR NE-343 and by stand age. Stand age may be determined by publically available historical materials documenting afforestation of the Project Area or presence of substantially complete tree cover on the Project Area. Stand age may be determined by coring a random or well distributed systematic selection of trees. If the Project Area is classified as one stand, at least 30 co-dominant trees well distributed across the Project Area will be used to calculate stand age. If the Project Area is divided into more than one stand, at least 20 co-dominant trees per stand will be used to determine stand age. For each stand, stand age shall be the median age of the sampled trees.

If using this quantification method, the Project must measure the percent canopy cover. The Project may prove canopy cover by using the i-Tree Canopy tool and submitting to the Registry the i-Tree Canopy report for the Project Area, plus the i-Tree Canopy export file containing the coordinates of all evaluated points and the evaluation of each point. If the estimated percent tree cover, minus one standard error of the estimate (i-Tree Canopy reports the standard error) is less than 80%, then the carbon stock attributed to the Project equal:

Project Stock = Stock * (Percent – Standard Error)

Where “Project Stock” is the number of tonnes of biomass carbon stock used for subsequent calculations of credits attributed to the project, “Stock” is the live tree or total non-soil carbon stock estimated using tables from GTR NE-343, “Percent” is the percent tree cover, and “Standard Error” is the standard error of the percent tree cover.

Because the tables in GTR NE-343 cover a wide range of conditions, some stands will have less carbon stock than the amount estimated by using the tables. To make the accounting conservative, if a project estimates carbon stock using these tables, the "Accounting Stock" shall be 80% of the "Project Stock" estimated in the equation above in this subsection.

B. An inventory of live trees at least 5" in diameter at 4.5' above the ground (where the height above the ground is measured on the uphill side of the tree) present on the Project Area using i-Tree methods and tools (available from http://www.itreetools.org/). When using this method, the Accounting Stock attributed to the project is up to the carbon stock calculated by i-Tree, minus one standard error of that estimate. For example, if the mean estimated carbon stock is 100 tonnes, and the standard error is 10 tonnes, then the number of Accounting Stock attributed to the project is 90 tonnes.

C. A forest inventory using accepted forestry methods and biomass equations that are valid for the species, growth conditions, and tree sizes to which the equations are being applied and that are published in a peer reviewed publication, by a government agency, or by a not-for-profit organization. The project may choose include smaller trees, standing dead trees, and/or down dead wood. When using this method, the Accounting Stock attributed to the Project is the mean estimated carbon stock, minus one standard error of that estimate.

10.2 Areas Expected to Remain in Trees After Potential Development

When an area is developed, some trees may be retained. This subsection adjusts the "Accounting Stock" calculated in the preceding subsection to adjust for the fact that even with development, some of the trees within the Project Area may remain, and the carbon in these remaining trees is not emitted during development. To account for these trees that might remain after development, the Project Operator must do the following accounting:

A. In industrial, commercial, mixed use, and non-residential zones, 90% of the Accounting Stock on developable portions of the Project Area is the "Avoided Biomass Emissions"; and

B. In residential zones where the zoning allows at least one dwelling unit per 6,000 square feet of lot size, 90% of the Accounting Stock on developable portions is the "Avoided Biomass Emissions"; and

C. In residential zones where the zoning requires more than 6,000 square feet of lot size for one dwelling unit, the Project Operator must divide the number of square feet of land in the Project Area that is within that zone by the required minimum number of square feet per dwelling to calculate the permissible number of dwelling units. The number of square feet of developable area that is subject to clearing and loss of carbon is the permissible number of dwelling units times 5,400 square feet per dwelling unit. This area is the developable area in the zone. For each residential zone that is within the project area and where more than 6,000 square feet of lot area is required for each permitted dwelling unit, the number of "Avoided Biomass Emissions" is calculated by multiplying the Accounting Stock times the number of permissible dwelling units that zone, then multiplying by 5400 square feet per dwelling unit, and then dividing this resulting number by the total project area in the particular zone. Where more than 6,000 square feet of lot area is require per dwelling unit, the calculation of the avoided biomass emissions is:

Avoided Biomass Emissions = Accounting Stock * ((Permissible Units * 5,400)/Project Area)

Where "Accounting Stock" is defined in Section 10.1, "Permissible Units" is the total number of dwelling units that zoning rules would allow to be constructed within the Project Area, and "Project Area" is expressed in units of square feet and is areas where development is permitted, as required in Section 4.3.A.

10.3 Re-measurement of Carbon Stock Necessary to Claim Additional Credits for Growth

If the project wishes to claim credits for ongoing tree growth occurring within the Project Area after the Project Commencement, only the quantified increase in biomass carbon from the prior issuance of credits may be requested. Increases may be quantified using any method approved by the Registry in Section 10.1, including deductions for calculation of the "Accounting Stock". The fraction of the "Accounting Stock" of new biomass sequestration in new growth that counts as "Avoided Biomass Emissions" is the same as the fraction that is the number of "Avoided Biomass Emissions" present at the project start date divided by the "Accounting Stock" present at the project start date.

10.4 Quantification of Soil Carbon

On acres determined to be at risk of conversion to developed uses where trees are cleared, as adjusted under the provisions of Section 10.2, the Project may claim avoidance of emissions from soil carbon caused by conversion of forest soils to impervious surfaces on developable portions of the project area. Avoided soil carbon emissions shall be no more than:

A. On commercial, industrial, and mixed use and other non-residential zones, if the applicable zoning and development rules specify a maximum fraction of parcel area that may be in impervious surface, up to the allowed impervious area may be claimed as avoided conversion to impervious surface. If the applicable zoning and development rules do not limit impervious area, 90% of the developable area within that Project Area and in commercial, industrial, or mixed use zone may be attributed to being eligible for conversion to impervious surface.

B. On residential zones, if the applicable zoning and development rules specify a maximum fraction of parcel area that may be in impervious surface, up to the allowed impervious area may be claimed as avoided conversion to impervious surface. If the applicable zoning and development rules do not limit impervious area, 50% of the developable area within that Project Are and in a residential zone may be attributed to being eligible for conversion to impervious surface.

C. For development uses of the project area that retain live vegetation on the ground, such as creation of recreational grass playfields, there are no soil carbon emissions attributed to development. If potential development of the Project Area would include some vegetative cover, and some non-vegetated surface uses (such as parking lots, restrooms associated with playfields, or artificial turf playfields) divide the Project

Area into areas with vegetation and without vegetation, and analyze each area separately.

If there is existing impervious surface within the Project Area, that existing impervious area must be subtracted from the potential area of impervious surface under developed use, to calculate net area of avoided impervious surface for calculating avoided soil carbon emissions.

Per acre of avoided impervious surface, the project may claim 120 metric tonnes carbon dioxide equivalent of Avoided Soil Carbon Emissions per acre of net avoided impervious surface. This emission rate is based on research studies showing that when soil is removed from a site and piled with minimal revegetation, 65% of the soil carbon stock is lost, and soil carbon mapping showing that almost all US forest soils have more than 185 metric tonnes carbon dioxide equivalent per acre in the top meter of soil. The calculation is:

Avoided Soil Carbon Emissions = Avoided Impervious Surface * 120

Where "Avoided Impervious Surface" is the number of acres within the Project Area that are developable according to the requirements of Section 4.3.A, in units of acres, after the adjustments specified in Sections 10.4.A and 10.4.B.

10.5 Calculation of Deduction for Displaced Development

Preventing development of some lands is likely to displace development to other lands. Displacing development to other lands may or may not cause emissions from trees and soil. If development is displaced to locations with no trees but with minimally disturbed soils, there would be no biomass emission attributed to the displacement but there would be soil carbon emissions resulting from the displacement. If development is displaced to previously developed sites, there could be negligible emissions from biomass and soil from sites where development is displaced to.

The project is assigned no emissions from displaced development if:

A. The Project Operator can identify existing properties within the urban area where the Project Area is located that are in the same or similar zoning classification (or classifications) as the Project Area, and

B. Those properties could be developed or re-developed to add similar scope and size of development as would have been allowed on the Project Area if it had not been protected. For uses where the potential developed use of the Project Area is vegetated cover, such as grass playfields, identify properties that are currently without trees that could be developed into the developed vegetated use.

If the Project Operator does not identify properties that could be developed or redeveloped to satisfy the demand for development that could have occurred in the Project Area, then emissions from displacement of development are calculated as follows.

A. Of the total number of tonnes of Avoided Biomass Emissions from within the Project Area, 28.8% are assumed to be emitted from development displaced from the Project Area. Therefore, the number of creditable tonnes of avoided biomass emission is calculated by reducing the number of tonnes of avoided biomass emissions attributed to within the project area by 28.8%. In the sequence of calculations, this reduction is done immediately prior to calculation of Reversal Pool obligations. The calculation is:

Credits from Avoided Biomass Emissions = Avoided Biomass Emissions * (1 - 0.288)

B. Of the total number of tonnes of Avoided Soil Carbon Emissions from within the Project Area, 57.1% are assumed to be emitted from development displaced from the Project Area. Therefore, the number of creditable tonnes of avoided soil carbon emission is calculated by reducing the number of tonnes of soil carbon emissions attributed to within the project area by 57.1%. In the sequence of calculations, this reduction is done immediately prior to calculation of Reversal Pool obligations. The number 57.1% is the fraction of U.S. cities that is non-impervious surface and assumes that some development is displaced to existing impervious surfaces. The calculation is:

Credits from Avoided Soil Emissions =
Avoided Soil Carbon Emissions * (1 – 0.571)

Credits attributed to the Project are the sum of Avoided Biomass Emissions plus Avoided Soil Carbon Emissions, after adjusting for displacement of development as provided for in this section.

10.6 Reversal Pool

Of the credits attributed to the project, verified by the Registry, and issued to the project, 90% shall be issued to the Project Operator and 10% shall be transferred to the Registry Reversal Pool.

11. Verification

The Registry will verify compliance with this Tree Preservation Protocol per International Standards Organization 14064-3. Specifically, the Registry adopts and utilizes the following standards from ISO 14064-3:

- Upon receiving a Project Report with updated data on eligibility, quantification of carbon, and a request for credits, the Registry will verify a project's compliance with this Protocol. The Registry will maintain its status as a non-profit organization, and will be independent of specific project activities.
- A trained peer reviewer will audit the Registry's verification, utilizing standards to be adopted by the Registry.
- Registry verification with peer review is justified by the processes and standard set forth below, and by the fact that urban forest planting projects, unlike many other types of carbon offset projects, will be conducted in urban areas, by definition. The trees planted in urban forest projects will be visible to virtually any resident of that urban area, and to anyone who cares to examine project trees.
- The Registry will maintain independence from the activities of projects, will conduct all verification work with ethical conduct and a fair presentation of its verification work, will treat all projects equally with regard to verification, and will conduct its verification work with skill, diligence, and competence.
- The Registry requires a reasonable level of assurance in the accuracy the asserted GHG removals to a reasonable level.
- The verification items identified in Table 11.2 and the following sections are all material elements, and any asserted GHG removals must be free of errors, misstatements, or omissions regarding those elements.

- The Registry will record, store, and track all quantification and verification data and either display it for public review or make it available for public review upon request.
- The Registry will develop a risk assessment standard to provide a cross-check on data collection and review.
- The Registry will adopt a process for follow-up and maintenance for consistency and continuity.

11.1 Verification of Eligibility Requirements

Table 11.2 displays the verification for eligibility requirements.

Table 11.2

Item	Elements to Verify	Protocol Section	How
1.	PO Identity	1.1	
2.	PIA	1.2	
3.	Location	1.3	
4.	Right to Receive Credits	1.4	
5.	Commencement	5	
6.	Project Documentation	4	
7.	Project Duration	3	
8.	Preservation Commitment	4	
9.	No Pre-existing Preservation	4	
10.	Threat of Tree Loss	4	

12. Verification of Project Operator's Quantification of Carbon

12.1 Quantifying Biomass Carbon Stock Within the Project Area under Section 10.1

What method was used to quantify biomass carbon stock?

A. A. US Forest Service table

B. B. i-Tree inventory

C. C. Other inventory

If A, US Forest Service General Technical Report (GTR) NE-343 table:

- Specify the state and forest type (or types) in which the project is located.
- Specify the table (or tables, if more than one forest type) used to estimate biomass carbon stock.
- Describe method for determining stand age. If documentary evidence, provide a copy of the document(s). If by coring, provide the sampling protocol, core data, and age calculation. If the project is measured as one stand and the stand age is measured by coring, are at least 30 trees aged? If the project is more than one stand, are there at least 20 trees cored in each stand? Is the median tree age used as the stand age?
- For each stand, what is the live tree or total non-soil carbon stock from the relevant table(s) in GTR NE-343, in metric tons CO2e/acre? For stand ages between ages given in the table, linearly interpolate. For stand ages older than the oldest age in the table, use the oldest age in the table.
- What is the percent canopy cover?
- If the i-Tree Canopy tool is used to determine the percent canopy cover, provide the i-Tree Canopy report for the Project Area, plus the i-Tree Canopy export file containing the coordinates of all evaluated points and the evaluation of each point.
- What is the i-Tree Canopy estimated percent canopy cover?
- What is the i-Tree Canopy standard error?
- What is the i-Tree Canopy estimated percent canopy cover minus one standard error?

- If the i-Tree Canopy percent cover minus one standard error is more than 80%, then the "Project Stock" per acre is the biomass carbon stock per acre from the GTR.
- If the i-Tree Canopy percent cover minus one standard error is less than 80%, then the "Project Stock" per acre is the biomass carbon stock per acre from the GTR times (the percent canopy cover minus one standard error).
- What is the "Project Stock" in tCO2e/acre, for each stand?
- Calculate the "Accounting Stock" by multiplying the multiplying the "Project Stock" times 0.8. What is the "Accounting Stock" in tCO2e/acre, for each stand? For each stand, multiply by the number of acres in the stand, and sum for all stands to calculate the total project "Accounting Stock". What is the total project accounting stock?

If B, the I-Tree Eco tool inventory method is used:

- What is the version of the inventory method used?
- Provide a copy of the tree data.
- Provide the i-Tree Eco report of the estimated carbon stock, and standard error of the estimate. In tCO2e/acre, for each stand (or stratum), what is the estimated tree carbon stock minus one standard error, for the entire project area, in tCO2e? This is the "Accounting Stock."

If C, a different inventory method is used:

- Provide the inventory field protocol, methods for calculating carbon stock from the inventory data, and electronic copy of the inventory data in an Excel or Access file, and a copy of the carbon calculations. Plot locations or plot information should be specific enough that if the Registry chooses, the Registry should be able to identify individual trees that were sampled, and discern sampled trees from trees that were not sampled. Provide inventory accuracy requirements, quality control procedures, and quality assurance procedures. Describe quality control and quality assurance activities performed, and the results of these activities. Provide complete citations of sources of all biomass equations, and demonstration of their applicability. Report the mean estimated carbon stock for the entire project area, in tCO2e, and the standard error of this estimate, in tCO2e. The "Accounting Stock" is the mean estimated carbon stock minus one standard error.

12.2 Area Expected to Remain Treed after Development Under Section 10.2

What is the percentage of the acreage of the project are that is developable, that is, where development is permitted and not prevented by zoning, hazard zones, sensitive areas, or other factors prohibiting development?

Multiply the Accounting Stock times the percentage that is developable. What is that amount? Section 10.2.1

- For the fraction of the developable area that is in non-residential zones, multiply the number in 10.2.1 by 0.9 and report this as the biomass carbon stock that could be lost on development, the "Avoided Biomass Emissions."

For the fraction of the area that is developable and that is in a residential zone, is more than 6,000 square feet required per dwelling unit? Section 10.2.2.

- If so, divide the developable area (in square feet) by the number of square feet required per dwelling unit, and round down to the nearest integer. Multiply this integer by 5400. This is the area that is assumed to be cleared of forest during development. Divide the area assumed to be cleared by the total project area and multiply this fraction times the Accounting Stock to obtain the "Avoided Biomass Emissions." Report the "Avoided Biomass Emissions."

If regulations allow one dwelling unit per 6,000 square feet or less, multiply the value determined in section 10.2.1 times 0.9 to calculate the "Avoided biomass Emissions." Report the "Avoided Biomass Emissions." Section 10.2.3.

12.3 Additional or Ongoing Growth Under Section 10.3

Claiming credits for ongoing growth is optional. If the Project Operator chooses to claim credits for ongoing biomass growth, these claims are made after growth occurs. Quantification of growth may use any of the methods given in section 10.1.

12.4 Quantification of Soil Carbon Under Section 10.4

Non-residential zones under Section 10.4.A. Avoided soil carbon emissions = (Developable area from section 10.2 minus pre-existing area of impervious surface) * 0.9 * 120. The areas must be in acres. Show the calculation and amount of avoided soil carbon emissions.

Residential zones under Section 10.4.B. If there is a limit on the fraction of the developable area from section 10.2 that may be impervious surface, take the lesser of 50% or the permissible fraction of lots that may be impervious surface. If there is no regulatory limit on the amount of impervious surface, then the fraction of developable area that may become impervious is assumed to be 50%. Avoided Soil Carbon emissions, in tCO2e) equals (the area that is developable (from section 10.2, in acres) minus the area of pre-existing impervious surface (in acres)) times the fraction that may become impervious times 120. Show the calculation and amount of avoided soil carbon emissions.

12.5 Displaced Development Under Section 10.5

Identifying available redevelopment options outside the project area under Section 10.5.1. Identifying available redevelopment options outside the project area is optional. If the Project Operator does not identify available redevelopment options, deductions for displaced development are applied to the project, as specified in Section 10.5.2 of the Protocol and below.

For Project Areas in non-residential zones, considering the developable area of the Project Area, applicable building setbacks and height limits, estimate the number of square feet of built space that could be built on the Project Area, on or above the existing grade. For Project Areas in residential zones, do the same calculation except calculate the number of permitted dwelling units instead of the number of square feet of potential built space.

For Project Areas in non-residential zones, identify specific land parcels within the same Urban Area where the project is located, and that have existing built space, and where at least the number of square feet of built space that could be built on the Project Area could be added to the built space already existing on these other parcels. Other than specific differences in regulations, the criteria used to estimate potential area of built space on the Project Area can be no more restrictive than the criteria used to estimate potential area of built space on the alternative sites. For example, if fire access regulations are used to reduce the area of potential built space attributed to the Project Area, then these same fire access regulations must be applied when estimating potential build space on parcels outside the Project Area. Provide addresses or parcel numbers of parcels used in these calculations, and provide annotated calculations.

For Project Areas in residential zones, identify parcels with at least one dwelling unit per parcel, where the parcel could be redeveloped to contain more dwelling units. Identify parcels that could contain as many more dwelling units as could be built on the Project Area. Provide addresses or parcel numbers of the parcels where dwelling units could be added, and annotated calculations of how many dwelling units each parcel could contain, and how many each currently contains.

Deduction for displaced development under Section 10.5.2. If the Project Operator does not show an option for alternative development within the Urban Area where the Project Area is located, a deduction for displaced development is applied. Displacement of emissions has a biomass component and a soil component. The amount of the biomass deduction for displaced development is the Avoided

Biomass Emissions times 0.288. The amount of the soil deduction for displaced development is the Avoided Soil Carbon Emissions times 0.571. Calculate these amounts and show the calculations.

12.6 Total Credits Attributed to the Project

The total credits attributed to the project equals the Avoided Biomass Emissions (section 10.2) plus the Avoided Soil Carbon Emissions (section 10.4) minus biomass and soil emissions attributed to displaced development (section 10.5).

If additional or ongoing growth is calculated, the same procedure is used to calculate growth. The Project Operator may either calculate the growth increment since the most recent quantification (using methods in section 10.1) or may estimate Avoided Biomass Emissions using the post-growth stand age or inventory, and then subtract amounts of credits previously attributed to Avoided Biomass Emissions of the project.

When calculating credits attributed to tree growth, no further credits are attributed for avoided soil emissions unless the allowed area of impervious surface has increased. If the allowed area of impervious surface has increased, to calculate the additional Avoided Soil Carbon Emissions calculate the Avoided Soil Carbon Emissions under the new regulations, and subtract the previously calculated amount of Avoided Soil Carbon Emissions attributed to the project.

Appendix A

Project Documentation, Reporting, and Record-keeping for Tree Planting and Preservation Projects

Public Comment Version 3

April 2017

Urban Forest Carbon Registry, a 501(c)(3) non-profit organization
999 Third Ave. #4600
Seattle, WA 98104
info@ufregistry.org
(206) 623-1823

A.1 Documentation to Submit a Project

Project Operators must provide the following documentation to submit their project to the Registry.

Document	When Submitted	Content Summary
Project Submittal Form	Once, at or within one year of Project Commencement	Project Operator, Location, Summary of Project
Project Plan	Once, with Project Submittal Form or within one year of Project Commencement	Design of Project, Compliance with Eligibility Requirements.
Project Implementation Agreement with the Registry	Once, within one year of Project Commencement	Agreement Binding the Project Operator, specific provisions to come
Signed Affidavit of Land Ownership or Permission per Section ___.	With Project Implementation Agreement, or upon any change in ownership or permission	Affidavit of Project Operator on Ownership of Land or Permission
Signed Affidavit of Compliance	With Project Implementation Agreement	Affidavit of PO on compliance with requirements of protocol

A.2 Documentation for Quantification, Verification, and Request for Issuance of Credits

Project Operators must submit the following documentation on status and to request verification and issuance of credits by the Registry.

Document	When Submitted/Required	Content Summary
Status Reports	Annually, at anniversary of project commencement	One-page report to be filled in confirming Project Operator, operational status, and any significant variations from Project Plan
Project Reports, including quantification of carbon	Always at end of Project Duration. Before that, at Project Operator's discretion, but required before verification or issuance of credits.	Status of Project, Update on Eligibility, project trees for Forward Credits, quantification, and comparison of projected carbon storage with quantified carbon if received Forward Credits.

A.3 Reporting During and at End of Project Duration

A Project Report must be submitted at the end of a project's Project Duration. During a project, the Project Operator may submit a Project Report and seek verification and issuance of credits at any interval chosen by the Project Operator. The Registry will not verify or issue credits without a Project Report.

Project Reports must contain:

a. Any updated information or data on eligibility, and

b. Updated project inventories, data on existence of project trees for issuance of Forward Credits, and any quantification data required by Section 9 and Appendices B or C on quantification and verification.

A.4 Record Keeping

Project Operators shall keep all documents and forms related to the project for a minimum of the 25-year Project Duration. If the Project seeks credits after the 25-year Project Duration, it must retain all documents for as long as it seeks issuance of credits. This information may be requested by the Registry at any time.

A.5 Transparency

The Registry requires data transparency for all Projects, including data that displays current carbon stocks, reversals, and quantification of carbon stored. For this reason, all project data reported to the Registry will be publicly available on the Registry's website or by request.

Appendix D

Discussion of Carbon Protocols and Principles

Public Comment Version 3

April 2017

Urban Forest Carbon Registry, a 501(c)(3) non-profit organization
999 Third Ave. #4600
Seattle, WA 98104
info@ufregistry.org
(206) 623-1823

Drafting Group

Zach Baumer
Climate Program Mgr.
City of Austin

Rich Dolesh
VP Conservation & Parks
National Recreation and Park Association

Ian Leahy
Dir. of UF Programs
American Forests

Scott Maco
Dir. of Research & Dev.
Davey Institute

Jenny McGarvey
Forest Programs Mgr.
Alliance for Chesapeake Bay

Greg McPherson
Research Scientist
U.S. Forest Service

Mark McPherson
Ex. Dir.
Urban Forest Carbon Registry

Darren Morgan
Manager
Seattle DOT

Walter Passmore
City Forester
City of Palo Alto

Shannon Ramsay
Founder
Trees Forever

Misha Sarkovich
Customer Solutions
Sacramento Municipal Utility District

Skip Swenson
VP
Forterra

Andy Trotter
VP of Field Ops.
West Coast Arborists

Gordon Smith
Ecofor, Seattle

Table of Contents

This Appendix D of the protocols contains a detailed discussion of the principles and standards applicable to carbon protocols in general and the development of the specific requirements in the Urban Forest Tree Planting Protocol and the Urban Forest Tree Preservation Protocol.

1. General Standards of Protocol Development

No single authoritative body regulates carbon protocols or determines final standards. The Stockholm Environment Institute's Carbon Offset Research and Education resource lists the various institutions and programs that have set out formulations of basic principles that every carbon offset protocol should contain.[1]

CORE lists twenty-five different programs or institutions that have either developed standards for protocols or issued standards and rules for their own programs. These institutions range from international bodies such as the Kyoto Protocol, the World Resources Institute, and the International Organization for Standardization, to U.S. carbon programs such as the Regional Greenhouse Gas Initiative and Midwest Greenhouse Gas Reduction Accord, to registries such as the American Carbon Registry, the Climate Action Reserve, and the Verified Carbon Standard.

The standards issued by these bodies vary, and the specific rules formulated to give content to these different standards vary even more. For example, the Clean Development Mechanism under the UN Framework stemming from the Kyoto Protocol lists 115 different approved baseline and monitoring methodologies for large scale offset projects.

[1] See CORE at http://www.co2offsetresearch.org/policy/ComparisonTableAdditionality.html

To complicate matters more, the environmental and carbon community have tolerated a de facto different standard between compliance protocols and voluntary protocols. Compliance protocols exist in cap and trade jurisdictions like California. Because these compliance protocols establish the rules for credits that will offset actual regulated GHG emissions from monitored sources, greater rigor is expected than in voluntary protocols, where purchasers are buying credits voluntarily to reduce their carbon footprint, not to offset regulated emissions.

There is, nonetheless, a general consensus that all carbon offset protocols must contain the following:

- Accounting Rules: offsets must be "real, additional, and permanent." These rules cover eligibility requirements and usually include baselines for additionality, quantification methodologies, and permanence standards.
- Monitoring, Reporting, Verification Rules: monitoring, reporting, and verification rules ensure that credits are real and verifiable.

Certification, enforceability, and tracking of credits and reversals are performed by specific programs or registries, guided by language in the protocol where relevant.

Over the last ten years, several documents setting forth standard and principles for protocols have emerged as consensus leaders for programs attempting to develop their own offset protocols for specific project types. We will follow and refer most often to:

- World Resources Institute/WBCSD GHG Protocol for Project Accounting ("WRI GHG Protocol");

- Clean Development Mechanism, Kyoto Protocol, now part of the UN Framework Convention on Climate Change ("CDM").

1.1 Recognition of Distinct Urban Forest Issues in Protocol Development

The task for the Urban Forest Drafting Group was to take the principles and standards set forth in these foundational documents and adapt them to urban forestry. As we described briefly in the Introduction to the Urban Forest Protocols, urban forestry and its potential carbon projects are different than virtually all other types of carbon projects:

- Urban forests are essentially public goods, producing benefits far beyond the specific piece of land upon which individual trees are planted.
- New tree planting in urban areas is almost universally done by non-profit entities, cities or towns, or quasi-governmental bodies like utilities. There are no for-profit entities in the U.S. that engage in new tree planting as their main business.
- Except for a relatively small number of wood utilization projects, urban trees are not merchantable, are not harvested, and generate no revenue or profit.
- With the exception of very recent plantings begun in California using funds from its Greenhouse Gas Reduction Fund, no one currently plants urban trees with carbon as a decisive reason for doing the planting.
- Because urban tree planting and maintenance are expensive relative to carbon revenues, urban forestry has not attracted established for-profit carbon developers.

- Because urban forest projects will take place in urban areas, they will be highly visible to the public and easily visited by carbon buyers. This contrasts with most carbon projects that are designed to generate tradeable credits purchased in volume by distant and "blind" buyers.

The WRI GHG Protocol recognizes explicitly that the principles underlying carbon protocols need to be adapted to different types of projects. The WRI GHG Protocol further approves of balancing the stringency of requirements with the need to encourage participation in desirable carbon projects.[2]

During the drafting process, we remained mindful at all times that the above unique factors of urban forestry distill down to three central attributes:

1. Urban trees deliver a broad array of documented environmental benefits,

2. Urban trees are essentially a public good delivering their array of environmental benefits to the people and communities living in cities and towns – almost 80% of the population, and

3. There are little to no harvests, revenues, or profits for those who preserve and grow the urban forest.

These three key attributes lead to the conclusion that urban forest projects are highly desirable, bringing multiple benefits to 80% of the population in a public good that is unlikely to be gamed or exploited.

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[2] WRI GHG Protocol, Chapter 3.1 at 19

Our task then was to draft urban forest protocols that encouraged participation in urban forest projects, while also addressing not just the principles of carbon protocols, but the policies underlying those principles.

2. Additionality

The rationale for additionality is simple: since carbon projects are offsets to emissions, they need to sequester additional carbon, not just give credits for carbon that would have been sequestered anyway.

The policy underpinnings of additionality seek to address two evils: no net carbon reductions and unjust enrichment to those who conduct business as usual.

What follows is an extended discussion of additionality. We begin by returning to the foundational principles and policies underlying the concept of additionality, particularly as set out in the WRI GHG Protocol guidelines.

We discuss the project-specific methodology and the perverse incentives that methodology creates for urban forestry. We set out the performance standard methodology and apply it to urban forestry, with data and a conclusion. And last, we discuss the legal requirements or regulatory surplus test and apply it to urban forestry.

The Registry is establishing a 40-year buffer (reserve) pool of additional forest carbon to collateralize or insure the urban carbon stored in Project trees. Buyers thus will receive two full stocks of CO2, so that even if all urban projects cease after year 25, the forest pool will store the same or more CO2 for 40 years. We will provide details on the forest buffer pool as they are developed and finalized.

2.1 Summary of Relevant Portions of the WRI GHG Protocol Guidelines

What follows now is a summary of the guidelines on additionality set forth in the WRI Protocol Guidelines. These guidelines clearly show the flexibility that the WRI intended to build into the development of carbon protocols.

The WRI GHG Protocol builds its additionality requirement into its baseline requirement for carbon projects. It also discusses various further or add-on additionality tests, like the legal requirements test, but it states that those additionality tests are entirely discretionary and depend on policy factors within the purview of the project developers. The WRI GHG Protocol indicates explicitly the need for flexibility for different project types:

The concept of additionality is often raised as a vital consideration for quantifying project-based GHG reductions. Additionality is a criterion that says GHG reductions should only be recognized for project activities that would not have "happened anyway." While there is general agreement that additionality is important, its meaning and application remain open to interpretation. The Project Protocol does not require a demonstration of additionality per se. Instead, additionality is discussed conceptually in Chapter 2 and in terms of its policy dimensions in Chapter 3. Additionality is incorporated as an implicit part of the procedures used to estimate baseline emissions (Chapters 8 and 9), where its interpretation and stringency are subject to user discretion.

While the basic concept of additionality may be easy to understand, there is no common agreement about how to prove that a project activity and its baseline scenario are different.

Setting the stringency of additionality rules involves a balancing act. Additionality criteria that are too lenient and grant recognition for "non-additional" GHG reductions will undermine the GHG program's effectiveness. On the other hand, making the criteria for additionality too stringent could unnecessarily limit the number of recognized GHG reductions, in some cases excluding project activities that are truly additional and highly desirable. In practice, no approach to additionality can completely avoid these kinds of errors. Generally, reducing one type of error will result in an increase of the other. Ultimately, there is no technically correct level of stringency for additionality rules. GHG programs may decide based on their policy objectives that it is better to avoid one type of error than the other. For example, a focus on environmental integrity may necessitate stringent additionality rules. On the other hand, GHG programs that are initially concerned with maximizing participation and ensuring a vibrant market for GHG reduction credits may try to reduce "false negatives"—i.e., rejecting project activities that are additional—by using only moderately stringent rules.

…There is no agreement about the validity of any particular additionality test, or about which tests project developers should use. ***GHG programs must decide on policy grounds whether to require additionality tests, and which test to require. Because their use is a matter of policy, the Project Protocol does not require any of these tests.***[3]

As the language above makes clear, additionality does not have to be applied on a project-specific basis. In fact, additionality is not a rule to be applied inflexibly, but rather a concept to be developed and adjusted for the context of each type of

[3] WRI GHG Protocol, Chapter 3.1 at 19

carbon project. The baseline methodology set out by the WRI allows for that kind of customization.

Given that we are developing two stocks of additional CO2, with the forest stock insuring or buffering the urban stock, we could develop a weak additionality test for the urban protocol. But we have developed a performance standard baseline using a method explicitly authorized by and set forth in the WRI GHG Protocol as an alternative to the project-specific test, and also a legal requirements test.

2.2 Project-Specific Methodology

Many people think of additionality as applied only on a project-specific basis, with the specific project or specific project developer being required to show that it reduced emissions (or removed them from the atmosphere) beyond its business-as-usual practices.

In the urban forest context, this produces immediate anomalies:

- Entities with a commitment to or even recent practice of tree planting and who begin carbon projects would get far fewer carbon credits than entities with no historical commitment to urban trees. To use the language of baselines, the baseline of entities that plant trees would be the trees they have annually planted, while the baseline of entities that plant no trees would be zero.
    - The City of Los Angeles has launched its Million Tree LA initiative (now CityPlants). These voluntarily planted trees would generate no carbon credits for LA, whereas a city like Bakersfield, which plants few to no trees, would get carbon credits for every tree it planted.

  - The same result obtains for an entity like the Sacramento Municipal Utility District, which voluntarily plants over 15,000 trees per year.
  - If additionality is applied inflexibly on a project-specific basis, then entities that plant trees now would have the perverse incentive to stop their planting, even temporarily, to bring their own business-as-usual baseline to zero.

- Governments with progressive tree ordinances or land use regulations that seek to increase canopy cover, would get fewer carbon credits because trees planted per their regulations would be part of their baseline and thus not eligible for crediting. Inflexible application of this "legal requirements" test leads to the perverse incentive for cities to leave their trees unregulated and unprotected.

2.3 Performance Standard Methodology

But there is a second additionality methodology set out in the WRI GHG Protocol guidelines – the Performance Standard methodology. This Performance Standard essentially allows the project developer, or in our case, the developers of the protocol, to create a standard using the data from similar activities over geographic and temporal ranges justified by the developer.

We understand that a common perception is that projects must meet a project specific test. Project-specific additionality is easy to grasp conceptually. The CAR urban forest protocol essentially uses project-specific requirements/methods.

But the WRI GHG Protocol clearly states that either a project-specific test or a performance standard baseline is acceptable.[4] One key reason for this is that regional or national data can give a more accurate picture of existing activity than a narrow focus on one project or organization.

Narrowing the lens of additionality to one project or one tree-planting entity can give excellent data on that project or entity, which data can also be compared to other projects or entities (common practice). But plucking one project or entity out of its context ignores all other data surrounding that project or entity. And that regional picture may be more accurate than one project or entity.

One pixel on a screen may be dark. If all you look at is the dark pixel, you see darkness. But the rest of screen may consist of white pixels and be white. Similarly, one active tree-planting organization does not mean its trees are additional on a regional basis. If the region is losing trees, the baseline is negative regardless of what one active project or entity is doing.

Here is the methodology in the WRI GHG Protocol to determine a Performance Standard baseline, together with the application of each factor to urban forestry:

WRI Perf. Standard Factor	**As Applied to Urban Forestry**
Describe the project activity	Increase in urban trees
Identify the types of candidates	Cities and towns, quasi-governmental entities like utilities, watersheds, and educational

[4] WRI GHG Protocol, Chapter 2.14 at 16 and Chapter 3.2 at 19.

	institutions, and private property owners
Set the geographic scope (a national scope is explicitly approved as the starting point)	Could use national data for urban forestry, or regional data
Set the temporal scope (start with 5-7 years and justify longer or shorter)	Use 4-7 years for urban forestry
Identify a list of multiple baseline candidates	Many urban areas, which would be blended mathematically to produce a performance standard baseline

The Performance Standard methodology approves of the use of data from many different baseline candidates. In the case of urban forestry, those baseline candidates are other urban areas. See Nowak, et al. *"Tree and Impervious Cover Change in U.S. Cities,"* Urban Forestry and Urban Greening, 11 (2012) 21-30).

As stated above, the project activity defined is obtaining an increase in urban trees. The best data to show the increase in urban trees via urban forest project activities is national or regional data on tree canopy in urban areas. National or regional data will give a more comprehensive picture of the relevant activity (increase in urban trees) than data from one city, in the same way that a satellite photo of a city shows a more accurate picture of tree canopy in a city than an aerial photo of one neighborhood. Tree canopy data measures the tree cover in urban areas, so it includes multiple baseline candidates such as city governments and private property owners. Tree canopy data, over time, would show the increase or decrease in tree cover.

Data on Tree Canopy Change over Time in Urban Areas

Our quantitative team determined that there were data on urban tree canopy cover with a temporal range of four to six years available from four geographic regions. The data are set forth below:

Changes in Urban Tree Canopy (UTC) by Region
(from Nowak and Greenfield, 2012)

City	Abs Change UTC (%)	Relative Change UTC (%)	Ann. Rate (ha UTC/yr)	Ann. Rate (m2 UTC/cap/yr)	Data Years
EAST					
Baltimore, MD	-1.9	-6.3	-100	-1.5	(2001–2005)
Boston, MA	-0.9	-3.2	-20	-0.3	(2003–2008)
New York, NY	-1.2	-5.5	-180	-0.2	(2004–2009)
Pittsburgh, PA	-0.3	-0.8	-10	-0.3	(2004–2008)
Syracuse, NY	1.0	4.0	10	0.7	(2003–2009)
Mean changes	-0.7	-2.4	-60.0	-0.3	
Std Error	0.5	1.9	35.4	0.3	
SOUTH					
Atlanta, GA	-1.8	-3.4	-150	-3.1	(2005–2009)
Houston, TX	-3.0	-9.8	− 890	-4.3	(2004–2009)
Miami, FL	-1.7	-7.1	-30	-0.8	(2003–2009)
Nashville, TN	-1.2	-2.4	-300	-5.3	(2003–2008)
New Orleans, LA	-9.6	-29.2	− 1120	-24.6	(2005-2009)
Mean changes	-3.5	-10.4	-160.0	-7.6	
Std Error	1.6	4.9	60.5	4.3	
MIDWEST					
Chicago, IL	-0.5	-2.7	-70	-0.2	(2005–2009)
Detroit, MI	-0.7	-3.0	-60	-0.7	(2005–2009)
Kansas City, MO	-1.2	-4.2	-160	-3.5	(2003–2009)
Minneapolis, MN	-1.1	-3.1	-30	-0.8	(2003–2008)
Mean changes	-0.9	-3.3	-80.0	-1.3	
Std Error	0.2	0.3	28.0	0.7	
WEST					

Albuquerque, NM	-2.7	-6.6	-420	-8.3	(2006–2009)
Denver, CO	-0.3	-3.1	-30	-0.5	(2005–2009)
Los Angeles, CA	-0.9	-4.2	-270	-0.7	(2005–2009)
Portland, OR	-0.6	-1.9	-50	-0.9	(2005–2009)
Spokane, WA	-0.6	-2.5	-20	-1.0	(2002–2007)
Tacoma, WA	-1.4	-5.8	-50	-2.6	(2001–2005)
Mean changes	-1.1	-4.0	-140.0	-2.3	
Std Error	0.4	0.8	67.8	1.2	

Absolute change is based on city land area
Relative percent change is based on percentage of UTC
Average annual change in UTC in hectares per year
Average annual change in UTC in hectares per capita per year

These data show that urban tree canopy is experiencing negative growth in all four regions. In other words, the urban tree canopy is shrinking. Even though there may be individual tree planting activates that increase the number of urban trees within small geographic locations, the urban tree canopy is declining in all cities but one in this data set, and is declining in every region.

The regional baselines from this data provide baselines for all projects within those regions. The Drafting Group did not use negative baselines for the Tree Planting Protocol, but determined to use baselines of zero.

Our deployment of the Performance Standard baseline methodology for an Urban Forest Protocol is supported by conclusions that make sense and are anchored in the real world:

- With the data showing that tree loss exceeds gains from planting, new plantings are justified as additional to that decreasing canopy baseline. In fact, the negative baseline would justify as additional any trees that are protected from removal.

- Because almost no trees are planted now with carbon as a decisive factor, urban tree planting done to sequester and store carbon is additional;
- Because virtually all new urban tree planting is conducted by governmental entities or non-profits, or by private property developers complying with governmental regulations (which would not be eligible for carbon credits under our protocol), and because any carbon revenues will defray only a portion of the costs of tree planting, there is little danger of unjust enrichment to developers of UF carbon projects.

2.4 Legal Requirement Test (also called the Regulatory Surplus Test)

The WRI GHG Protocol discusses the so-called Legal Requirement Test. This is identified in the UN's Clean Development Mechanism as the Regulatory Surplus Test. These tests disqualify any credits for carbon stored to meet a pre-existing legal requirement. In other words, the carbon stored must be surplus to carbon stored per legal or regulatory requirements.

If these tests are applied literally, then any tree planted per a city ordinance or code for any reason, such as shade trees for parking lots, would not be additional. But in fact, the WRI GHG Protocol guidelines state clearly that application of the Legal Requirement Test is optional. Among the factors relevant to that decision are policy considerations such as other co-benefits from a project or whether a too-stringent application of the test will limit participation in the protocol. Give the documented co-benefits of urban trees, including potential environmental justice, and given the national decline in tree canopy, there is a persuasive case for eschewing the legal requirements test altogether.

But the Drafting Group determined that the Urban Forest Tree Planting Protocol should declare ineligible trees that are planted due to an enacted ordinance or law. Some cities have policies of replacing trees on public property, but these policies are advisory and do not rise to the compulsion of an enacted ordinance.

Our development of a legal requirement test that declares ineligible trees required by ordinance or law to be planted is supported because the baseline of the urban tree canopy is negative.

Moreover, the WRI GHG Protocol explicitly allows a balancing of stringency with the need for participation in desirable project types. Given the many environmental benefits of urban trees, delivered to the 80% of the population that lives in cities and towns, our legal requirements test is appropriate.

2.5 Additionality in the Tree Preservation Protocol

Our Drafting Group modeled the Tree Preservation Protocol on the "Avoided Conversion" type of project for forest land. We have provided that urban trees that are under threat of removal, and that are protected from removal, should be eligible to earn carbon credits.

The Avoided Conversion model that we borrowed from the forest context rests on a simple and common sense idea. Forested parcels that are protected from development are additional in that they would have been removed by the development. Therefore, the owners of that protected land should be able to earn carbon credits for those trees protected from development.

Additionality per se is generally not in dispute in forest Avoided Conversion projects. The trees that would have been cut down for development are saved, therefore they are additional from the time they are preserved from development. Every day they are protected from removal is an additional day of CO_2 storage in those trees.

But the simple idea of avoided conversion has proven difficult to capture in the rules of most forest Avoided Conversion protocols. For it is based on two real-world problems. First, proving that trees would be lost to development is counter-factual. How can a project developer show something that has not happened but that is supposed to be imminent and inevitable? If the land ends up being protected from development such that it could qualify for avoided conversion carbon credits, then development of the land could not have been inevitable after all.

This counter-factual predicament is magnified by the failure of most forest Avoided Conversion protocols to identify and define the two key underlying elements of a threat of conversion, which are imminence and inevitability. Because these two key parts of the threat of conversion are not clearly identified and addressed, the rules can become either too vague or overly detailed.

Second, for the Avoided Conversion forest protocol to be consistent with general carbon protocol principles, a project developer should show not only that the land would have been developed, but also that it was saved from development for the carbon storage of the trees on it. If the land was saved for reasons other than carbon storage, then that storage and those carbon credits would not be additional. Yet, we are not aware of an Avoided Conversion forest protocol that addresses this issue.

What does seem clear in both the forest and the urban forest context is that any tree preserved from removal is additional. And the CO_2 stored in those preserved trees is additional for as long as those trees are standing.

Moreover, we know from the baseline data utilized to develop the performance standard that urban tree cover is declining. The baseline is negative. This means that the difference between the negative baseline and zero is all additional. For the Tree Planting Protocol, the Drafting Group decided to use a baseline of zero, in effect ignoring the negative baseline. But for Tree Preservation projects, the negative baseline adds support for the additionality of any tree preserved. Any tree protected from removal within the delta of the negative baseline and zero is additional.

As with the forest Avoided Conversion protocols, we have not tried to parse the meanings of imminence and inevitability. Doing this seems more important for forest projects, because forest lands have widely varying threats of removal. Forest land near rural cities or towns is at much higher risk than forest land remote from human settlement.

Most urban trees on private property, by contrast, are under a continual background threat. The simple but inexorable force of land values in urban areas often gives a higher value to land with built improvements than bare land with trees. The only workable tools to mitigate this threat of removal are public ownership of land, laws protecting urban trees from removal during development, and some form of financial incentive, such as carbon revenues, to preserve urban trees.

For purposes of the Urban Forest Tree Preservation Protocol, we follow the Avoided Conversion forest protocols in that we do not define imminence or devise a set of rules to demonstrate it per se. Rather, we set out the protections required to preserve trees from removal or conversion. We also set out a list of factors that a Project Operator could select from to show the threat of conversion. These factors include a threshold land price, perimeter development, and highest and best use studies.

If a project operator shows a threat of removal under the protocol, then the trees preserved from removal are additional from the day they are preserved.

3. Permanence

Permanence embodies the principle that carbon stored should not be reversed. Here is the WRI summary of Permanence:

Emission reductions or removals are permanent if they are not reversible; that is, the emissions can't be rereleased into the atmosphere. The issue of permanence applies to projects where emissions are sequestered in ways that could be reversed over time, such as in forests (which can release carbon through fires or decay) and through geological sequestration (where gases could potentially leak unexpectedly). *There are mechanisms to account for or reduce the risk of reversal, though they can bring additional costs. These include buying insurance in case of emissions reversals, establishing a reserve "buffer" pool of credits or issuing temporary credits from the project that are valid for a period of time but must be re-certified or replaced in the future.* [Emphasis supplied][5]

The above language specifically refers to "buying insurance," creating a buffer or reserve pool, and even issuing temporary credits. The Registry is establishing a 40-year buffer (reserve) pool of additional forest carbon to collateralize or insure the urban carbon stored in Project trees. This buffer or reserve pool will

[5] World Resources Institute, *Bottom Line On...*, Issue 17 (August 2010)

act as insurance or collateral for forty years for the urban carbon stored in planting projects under the Registry.

3.1 Time Period

This statement makes no reference to a time requirement for permanence. Rather, the permanence requirement focuses on reversals. This makes sense, because if carbon storage is never reversed, then no time period is necessary. But few human efforts are "never" reversed or truly permanent.

So, the Climate Action Reserve, to take one example, follows the IPCC lead and imposes a 100-year permanence requirement on all of its protocols, with reversal mechanisms for projects that receive progress credits before their 100-year period. But even 100-year carbon storage is not permanent, and carbon stored for those 100 years has no guarantee of staying stored at the end of the 100 years.

Other protocols have adopted a 40-year project duration, preferring to use terms like "Minimum Project Commitment" rather than Permanence (see Improved Forest Management on American Carbon Registry, for example.) The Regional Greenhouse Gas Initiative was willing to accept a 40-year permanence period for its offset projects. Still others have developed risk calculators or assessments, with a sliding scale of "permanence."

So it is clear that many developers of protocols have struggled to create a permanence requirement. The 100-year period of the Climate Action Reserve and the 40-year period of the American Carbon Registry and RGGI are two examples. But it is difficult to reconcile the 60-year difference between these two duration requirements.

In our Tree Preservation Protocol, we require a 40-year preservation commitment, shown either in an easement or, for trees on public lands, a management or protected status for forty years.

For tree planting projects, we had to use a shorter time period and find a different solution to this issue. Our solution is to establish a 40-year buffer or collateral pool of CO2 to back up all of the urban CO2 stored in urban forest planting projects. Because the urban CO2 is backed up for 40 years, we can then set a project duration that will work for urban forestry – 25 years. The years past 25 will result in the greatest CO2 storage, so projects have a strong incentive to continue.

The Drafting Group felt strongly that, because most urban forest projects are funded and executed by cash-short cities and towns and local non-profits, a 40-year commitment will render the protocol unusable. Even a 25-year duration may eliminate worthy projects. But in any event, the CO2 stored in 25-year urban projects is backed up for 40 years.

Some of the unique factors of urban forestry support our method of addressing the permanence issue:

- No one harvests the urban forest, so there is no danger of a Project Operator choosing to terminate its carbon project to reap the profits of harvest. Termination of a forest project for harvest, on the other hand, is a quite real danger where owners are continually assessing the costs and revenues of carbon storage against the profits of harvest.
- With no threat of harvest looming, an urban tree that survives into its second or third decade has a strong probability of surviving for many more years.

- If an urban forest carbon project receives credits for carbon storage at year 15, for example, the carbon storage will grow as the trees grow, so that incidental mortality will likely not lower the carbon stored in that project.

- It is highly unlikely that an entire urban forest will be destroyed by a fire or disease, as can happen with forest land. Most cities have a diversity of species that would mitigate the effect of a disease that afflicted a species.

- Urban forests need to have diversity of species and age, as well as functional diversity. Different species perform certain functions better than others (reducing pollution, providing certain health benefits), and a diverse and healthy urban forest needs to reflect that functional diversity as well as age and species.

- Urban trees are expensive to plant and maintain. Even if urban forest credits commanded a price of $20 per tonne, carbon revenues will likely defray only 5 to 30% of the costs of planting and maintaining a tree. Given the many benefits of urban trees beyond carbon storage, a permanence period must not be so long as to choke participation in these important projects.

- Dynamic land uses and property ownership in cities and towns makes a long permanence period impossible.

- A significant percentage of urban forest funding decisions are made by elected officials. We may hope that our elected officials have a long-term view of our cities and towns, but all too often the time horizon of elected officials is the election cycle. A long permanence period will dramatically discourage most elected officials from promoting participation in urban forest carbon projects.

- Many analysts predict that renewable energies will overtake fossil fuels in 20 years. If that is the case, our permanence goal would be a bridge to those renewable energy sources in 20 years.

For all of these reasons, our Drafting Group determined that a 25-year Project Duration period was the best time period to adapt the principles underlying the permanence standard to urban forestry. We believe that most projects will continue long past the 25-year Project Duration. Projects have every incentive to do so, because they could earn carbon credits after that period, having already invested in making a project successful for its first 25 years.

We have also included specific rules on reversals, so that credits reflecting carbon stored must be earned or compensated.

4. Issuance of Credits

With respect to the issuance of credits, our urban forest protocols break ranks with most carbon protocols and registries in a significant way:

- We will issue so-called Forward Credits; i.e., we will issue credits early in projects, before carbon has been actually stored and quantified.

We understand the strong antipathy for forward credits and the reasons underlying that antipathy. But with the urban CO2 fully backed up by forest CO2 for 40 years, the Forward Credits we issue will be completely insured. The Forward Credits will be fully secure because the credits are fully buffered or collateralized in a duplicate stock of CO2.

Here are the reasons we have developed Forward Credits and why they make sense for both projects and carbon buyers.

4.1 Forward Credits

Forward credits in an urban forest tree planting protocol are not merely desirable, they are indispensable. Almost no urban forest projects can wait for 25 years to receive funding. Elected and agency officials are all too often required to plan with the timeline of an election cycle, not a Permanence standard in a carbon protocol and not a 25-year waiting period for tree growth and carbon storage.

So our challenge was to develop a forward crediting method that would provide assurance to carbon buyers that the carbon reflected in a Forward Credit would be stored. We needed to find a way to show the buyers that any Forward Credits issued are, in effect, guaranteed.

We note first that our society has developed many mechanisms analogous to a Forward Credit where a person or entity receives money or something of value, and then performs a service or pays that money back over time:

- A bond issuer receives the proceeds of a bond in year 1, and then pays that bond back over time.
- A homeowner receives mortgage loan proceeds to purchase a house, and then occupies the house while paying back the mortgage loan over time.
- A contractor receives partial payment before beginning work, and delivers the service over time.
- A landlord receives rent at the beginning of a month and delivers a habitable swelling unit over the next month.

In all these examples, and many more, the parties have agreed to an early delivery of money in exchange for some type of performance later. They have dealt with the risk of later nonperformance by negotiating mechanisms that reduce that risk to acceptable levels. A mortgage lender, for example, requires a minimum loan to value ratio and also a security interest or deed of trust on the property purchased with the loan proceeds. With these in place, the lender has reduced its risk to acceptable levels. Similarly, a bond holder receives less interest the higher the credit rating of the bond issuer and the bond. The bond holder in effect pays more for a more secure promise of later performance.

The large carbon registries have been wary of early issuance of credits, because they have been justifiably worried that carbon developers will take the money and run; i.e., that the carbon developers will not perform their promise to store carbon after credits have been issued.

Our task for the urban forest protocol then, given that we need to issue Forward Credits to make urban forest carbon projects possible, was to analyze potential urban forest carbon projects to determine where the risks were. Where and what, we asked, are the risk points in urban forest projects? Where could projects fail, or be abandoned? And how can we assure performance or coverage around those risk points, so that a Forward Credit is essentially guaranteed to do what it promises, which is to store carbon for a defined time period.

Risk Points

Here are the risk points we identified in tree planting projects:

- Will the Project Operator plant the trees?

- Will the trees survive past year 3, given that mortality is higher in the early years of an urban tree's life than in later years?
- Will the trees survive past year 5, given that data supports the conclusion that mortality drops significantly after year 5?
- Are there risk points for large scale mortality due to disease, fire, natural disaster, and other events?
- Is there a risk that the Forward Credits issued will represent more carbon than is actually stored in project trees by the end of the project?

To address the first three and the fifth of these risk points, we developed a tiered or staircase release of Forward Credits, triggered by a Project Operator's demonstration that it has passed particular risk points:

1. After planting of project trees: 10% of projected total carbon stored by Year 26;
2. After Year 3: 40% of projected total carbon stored by Year 26;
3. After year 5: 30% of projected total carbon stored by Year 26;
4. At the end of the 25-year Project Duration and after quantification and verification of carbon stored: "true-up" credits equaling the difference between credits already issued (which were based on projected carbon stored) and credits earned based on quantified and verified carbon stored;
5. 5% of total credits earned will be retained by the Registry at the last issuance of credits to a Project for use in a Registry-wide Reversal Pool;

Forward Credits are thus released only after a project successfully passes through a risk point. And 10% of projected credits are withheld until the end of the project, when a true-up of Forward Credits with carbon stored occurs.

The fourth risk point – fire, disease or some cataclysmic event – we consider remote. A forest fire can sweep through a large stand of forest. But urban fires rarely consume large areas. Some diseases, like Dutch Elm Disease, can over time devastate a species, but most cities have learned the lessons of Dutch Elm Disease and plant a variety of species. Nonetheless, to insure against that unlikely risk of cataclysm, we have provide for retention of 5% of credits earned in a Buffer Pool, to be held by the Registry.

As final and tertiary level of absolute assurance, we repeat that we are working to establish a pool of forest CO2 as a buffer or collateral pool to back up the Forward Credits. This buffer pool will provide a third layer of protection for any buyer concerned that an urban forest project will not store the CO2 promised.

5. Quantification

Quantification methods for Tree Planting projects are set out in Appendix B. The methods are the Single Tree Method, for smaller projects or trees planted non-contiguously, and the Tree Canopy Method, for trees planted in groups, and for forward credits based on projected CO2 storage.

Appendix B shows the spreadsheet tools for both the Single Tree and Canopy Methods and for Forward Credits. These tools significantly streamline the quantification process. Users will enter data in progressive sheets of the spreadsheets, and the spreadsheets will perform the appropriate calculations to give totals. We will create 16 versions of each of these spreadsheet tools, so each of the 16 climate zones will have a tool for each method.

Quantification methods for tree preservation projects are set out in Section 10 of the Tree Preservation Protocol. This 5-step process essentially uses forest and soil carbon quantification, with deductions for a baseline of trees that would have remained even if the land had been developed and for displaced development.

6. Verification

We have set out the verification guidance in Appendix C on Verification for Planting projects and in the Preservation Protocol itself for preservation projects.

Verification is yet another area where the reality of urban forest projects collides with customary practice at large carbon registries and large carbon projects. The scale of the large carbon projects, and the potential revenues, allows for the costs of third-party verification, usually done by professional firms whose fees are substantial.

It was clear to the Drafting Group that many urban forest projects would not be able to afford to pay the substantial fees charged by third-party verification firms. The third-party verification fees would be the single largest expense of many urban forest carbon projects and would cannibalize the revenues.

Rather than impose verification costs on individual projects, we developed a verification process at the program level. As the protocols and Appendix C set out, we will perform verification at the Registry level, using the standards in ISO 14064-3. Appendix C and the verification guidance in the Preservation Protocol set out the process and standards.