URBAN FOREST CARBON REGISTRY

CARBON CREDITS FOR CITY TREES

Appendix D

Discussion of Carbon Protocols and Principles

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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.

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[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.

[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.