City Forest Credits Planting Protocol
Riparian Planting Quantification and Monitoring
Standards and Requirements in the South Central Climate Zone

Carbon Quantification

Riparian planting projects can request Carbon+ Credits from City Forest Credits (CFC):

- 10% after planting is completed
- 40% after Year 3 (i.e., in Year 4)
- 30% after Year 5 (i.e., in Year 6)
- Remaining credits at end of project duration (at Year 26)

The Credits will be based on the quantification performed by our forest scientists. Their calculations are in turn based on information Project Operators provide, including:

- Species planted
- Numbers of each species
- Number of acres planted
- If the project is planted in separate areas, then you would also provide the planting list for each area

There are two different methods for quantifying carbon dioxide (CO_2) storage in urban forest carbon projects – the Single Tree Approach (where planted trees are few or are scattered among many existing trees) and the Tree Canopy Approach (where planted trees are relatively contiguous). Instead of using the traditional the Tree Canopy Approach for riparian tree planting projects in Austin, we use a forest ecosystem approach. The traditional approach, which is based on the biometrics of open-growing urban trees, cannot adequately describe biomass distribution among closely-spaced trees and the dynamic changes in CO_2 stored in dead wood and understory vegetation as a riparian forest stand matures.

In our modified approach the amount of CO_2 stored after 25-years by planted project trees is based on the anticipated amount of tree canopy area (TC). The forecasted amount of CO_2 stored at 25-years is the product of the amount of tree canopy (TC) and the CO_2 Index (CI, t CO_2 per acre). This amount is the value from which the Registry issues forward credits in the amounts of 10%, 40% and 30% at Years 1, 3 and 5 after planting, respectively. A 5% buffer pool deduction is applied, with these funds going into a program-wide pool to insure against catastrophic loss of trees. At the end of the project, in year 25, the Operator will receive credits for all CO_2 stored, minus forward credits already issued.

To provide an accurate and complete accounting of carbon pools in these riparian projects we used the US Forest Service General Technical Report (GTR) NE-343, with its allometrics for the elm/ash/cottonwood forest ecosystem in the South Central region (Smith et al., 2006). The table we used (B50) provides carbon stored per hectare for each of six pools as a function of stand age. We used values for 25-year old stands for afforestation projects, because the sites contain little carbon in down

dead wood and forest floor material at the time of planting. Data used to derive the 51 forest ecosystem tables came from U.S. Forest Inventory and Assessment plots. More information on methods used to prepare the tables can be found in Smith et al. (2006).

Following guidance in GTR NE-343 we adjusted the GTR NE-343 values for live wood, dead standing and dead down wood using local plot data provided by the team. According to the plot data the mean amount of C stored in all tree biomass was 24 t/ha. This value does not include biomass of invasive woody species. Lacking a measured breakdown of this total for trees among the live, standing dead, and down dead biomass components, the 24 t/ha was proportionately distributed as per the GTR (i.e., live: 87%, 20.9 t/ha; standing dead: 7%, 1.7 t/ha; down dead: 6%, 1.4 t/ha). The remaining three carbon pools (understory, forest floor, and soil) remained the same as in GTR Table B50 because their values are independent of tree biomass. The customized values are shown below in Table 1. Carbon in the tree pool totals 24 t/ha and accounts for 33% of the total 71.9 t/ha after 25 years for this forest ecosystem. Soil organic carbon is the single largest pool (56%).

After conversions, **the CO_2 Index (CI) is 106.7 t CO_2 per acre of tree canopy (TC) and the forecasted amount of CO_2 stored after 25-years is the CI x TC.** This is the value from which the Registry will issue forward credits (Table 1).

Table 1. Estimated amounts of carbon stored in each pool at 25-years after planting for riparian forest projects in Austin, TX. These values are based on local plot data for these types of forests and values from GTR NE-343 for the elm/ash/cottonwood forest ecosystem in the South Central region.

elm/ash/cottonwood	t/C/ha	t/CO2/ha	t/CO2/ac	% total
live tree	20.9	76.8	31.08	29%
std dead tree	1.7	6.1	2.48	2%
understory	3.3	12.1	4.90	5%
down dead wood	1.4	5.1	2.07	2%
forest floor	4.4	16.1	6.53	6%
soil	40.2	147.4	59.68	56%
total	71.9	263.6	106.73	100%

Monitoring Requirements

Projects need to submit annual monitoring reports. At years when Credits are requested, additional information is needed.

Within one year of planting, Project Operators provide:

- Request for Third-Party Verification and Credits
    - Project Design Document, which includes quantification
- Imaging of the trees through photos
    - Select points and take geo-coded photos that when taken together capture the newly planted trees in the project area
        - If site is rectilinear, take a photo at each of the corners. If the site is large, take photos at points along the perimeter looking into the project area. If necessary to capture the trees, take photos facing each of the cardinal directions while standing in the middle of the project area
        - If site is nonrectilinear, identify critical points along property boundaries and take photographs at each point facing in towards the middle of the site. Next, take photographs from the middle of the project area facing out at each cardinal direction.
- Project Operator Declaration of Planting
    - Include supporting documentation listed on the Project Operator Declaration of Planting template
- Declaration of Planting Affirmation
- Declaration of Land Ownership or Agreement to Transfer Credits

After Years 3 and 5:

- Project provides images of the Project Area from any telemetry, imaging, remote sensing, i-Tree Canopy, or UAV service, such as Google Earth and estimate the area in tree canopy cover (acres).
    - Imaging from Google Earth with leaf-on may be used. Project operators will calculate the percent of canopy cover from the Google Earth imaging
    - Projects can use i-Tree Canopy and point sampling to calculate canopy cover. Using i-Tree Canopy, continue adding points until the standard error of the estimate for both the tree and non-tree cover is less than 5%. i-Tree Canopy will supply you with the standard errors.
    - If tree canopy cover is determined using another approach, such as image classification, a short description of the approach should be provided, as well as the QA/QC measures that were used. A tree cover classification accuracy assessment should be conducted, as

with randomly placed points, and the percentage tree cover classification accuracy reported.

- Progress Requirements after Years 3 and 5:
    - After Year 3, projects must show canopy coverage of at least 12% of the Project Area (three years as a percent of 25-year project duration)
    - After Year 5, projects must show canopy coverage of at least 20% of the Project Area (five years as a percent of 25-year project duration)

  Note: if projects exceed these progress requirements, they will not receive credits early or out of schedule. If projects fail to meet the progress requirements, they will not be eligible to request credits until they meet the progress requirements.

Quantification and Crediting after Year 25:

- Project provides images of the Project Area from any telemetry, imaging, remote sensing, i-Tree Canopy, or UAV service, such as Google Earth and estimate the area in tree canopy cover (acres).
    - Imaging from Google Earth with leaf-on may be used. Project operators will calculate the percent of canopy cover from the Google Earth imaging
    - Projects can use i-Tree Canopy and point sampling to calculate canopy cover. Using i-Tree Canopy, continue adding points until the standard error of the estimate for both the tree and non-tree cover is less than 5%. i-Tree Canopy will supply you with the standard errors.
    - If tree canopy cover is determined using another approach, such as image classification, a short description of the approach should be provided, as well as the QA/QC measures that were used. A tree cover classification accuracy assessment should be conducted, as with randomly placed points, and the percentage tree cover classification accuracy reported.
- Project calculates total CO_2 storage at end of Year 25 as follows:
    - Multiply the CI (supplied by CFC) times the TC (Tree Canopy Cover in acres)
    - Deduct the number of Credits already issued
    - Result is the number of credits to be issued to the project, minus the 5% hold-back for the reversal pool
    - After third-party verification, CFC issues credits per the verification report and the protocol

Background notes:

- Canopy plantings do not track tree loss because they are ecological projects seeking canopy. Canopy plantings anticipate relatively high tree loss compared to single tree or street-tree type plantings.
- Canopy is generated by the recruitment of species on the site and by planting a variety of smaller and larger species that provide canopy quickly. Larger species that out-compete others provide longer-term canopy coverage.
- Because of the above, the precise number of trees planted is not the key to a successful canopy project. That success often relies on recruitment and the competition of species that enable the success of some trees at the expense of others.

References

Smith, James E.; Heath, Linda S.; Skog, Kenneth E.; Birdsey, Richard A. 2006. Methods for calculating forest ecosystem and harvested carbon with standard estimates for forest types of the United States. Gen. Tech. Rep. NE-343. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 216 p.