

DEVELOPING AN URBAN FOREST CARBON MARKET

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Abstract

Countries, states, localities, businesses, and individuals are taking action to mitigate greenhouse gas levels and production as a response to concerns over climate change. Europe currently has mandatory greenhouse gas emission legislation and a large developed emission trading market, as opposed to the U.S. where voluntary markets to reduce greenhouse gas emissions are still developing. An integral part of these markets is permanently reducing or sequestering carbon dioxide (CO₂) to create a carbon credit and then selling this carbon credit. Currently, there is little differentiation between methods and locations of projects that create carbon credits. This project looks to investigate the potential for an U.S. urban forest carbon market. A supply of urban forest carbon in the U.S. exists as evidenced by urban forests sequestering 88.5 million tons of CO₂ in 2005, representing approximately 1.5% of the total U.S. CO₂ emissions. Not only is the supply significant, but it is also growing, as the amount sequestered in 2005 is approximately 53% greater than the amount sequestered in 1990. The interest, motivation, and willingness of market participants are determined by use of surveys. Potential urban forest carbon sellers, such as cities and urban counties, were surveyed to obtain insight to the feasibility of an urban forest carbon market.

Keywords: Forest carbon, urban carbon, carbon markets, urban forests

Introduction

The world climate is changing. The Pew Center on Global Climate Change (2008) reports that global temperature has increased 1.4 degrees Fahrenheit since 1900, that twenty-two of the hottest years on record occurred since 1980, and that the past ten years were the hottest in the last

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150 years. Global climate change may affect precipitation patterns, biodiversity, flood and drought cycles, and public health. As global temperature increased, atmospheric greenhouse gas levels also rose. Greenhouse gases include carbon dioxide, methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons, and sulfur hexafluoride. Many scientists believe that human activity lead to the increased levels of atmospheric greenhouse gases, which in turn caused the increases in global temperature.

Currently, there are many programs and initiatives, some mandatory and others voluntary, to reduce the atmospheric levels of greenhouse gases. Most of these programs involve both reducing greenhouse gas emissions and sequestering atmospheric carbon. For example, the European Union's Greenhouse Gas Emission Trading Scheme (EU ETS 2008) is a mandatory cap and trade program that includes all 25 member countries of the European Union and requires member countries to reduce their emissions to levels outlined in the United Nations Framework Convention on Climate Change's Kyoto Protocol. In contrast, U.S. companies, governments, and organizations are voluntarily reducing their greenhouse gas emissions through the Chicago Climate Exchange (CCX 2008) and independent actions. The Chicago Climate Exchange (2008) is the largest voluntary trading system to reduce emissions of all six major greenhouse gases, with offset projects worldwide. A common trait in many of the mandatory and voluntary trading schemes is the idea of offset projects. The EU ETS and the CCX allow companies to purchase certified sequestered carbon that was sequestered or avoided from a variety of approved projects. For the CCX, these offset projects include agricultural methane, agricultural soil carbon, energy efficiency and fuel switching, forestry carbon, landfill methane, renewable energy, coal mine methane, range land soil carbon, and ozone depleting substance destruction. The CCX does not differentiate between the different projects as it sells a single financial instrument to represent the certified sequestered carbon from the projects. Ecosystem Marketplace (Hamilton et al. 2008) reports differing prices for different project types that were traded between private parties, not in the CCX. The report states that "forestry projects, in particular those involving afforestation/reforestation, have remained some of the highest priced project types across 2006 and 2007 with weighted average prices of \$6.80 to \$8.20 per metric ton of CO₂ equivalent." The report also states that there were differing prices for projects in different geographic areas.

For this project, the investigators look at the potential for an urban forest carbon market that would provide urban carbon offset projects. The urban forest carbon resource is attractive as a source of offset projects because of its location and size. Over 75% of the U.S. population resides in urban areas and represent the major source of greenhouse gas emissions. In addition, the urban area in the U.S. is growing. From 1969 to 1994, urban area in the U.S. doubled in size to cover 3.5% total land area of the U.S. (Nowak et al 2001, Nowak and Crane 2006). This manuscript will discuss the preliminary results from a survey of local governments that were identified as potential suppliers of urban forest carbon.

Methods

The investigators identified local governments as potential sources for urban forest carbon to be sold in an urban forest carbon market. The investigators used a survey to determine the ability, willingness, interest, and motivation of local governments to supply urban forest carbon. Urban foresters and arborists were selected as the respondents best able to provide the desired

information. The International Society of Arborists (ISA) is the trade society for arborists and urban foresters. The ISA hosts the Society of Municipal Arborists (SMA) that is a subgroup of arborists who work with municipalities and local governments. SMA members were selected to receive the survey. The raw response rate for the survey was 54%.

The survey was composed of 27 questions and covered three topic areas. The first area asked about urban forest management and requested information, such as who manages the urban forest resource and what inventories are available. The second area asked about interest and activities in climate change mitigation, such as participation in voluntary carbon markets. The third area asked about city characteristics, such as city land area. Respondents were asked to respond for the city, as opposed to providing their own opinions.

Results

The first part of the survey focused on available inventory information and management. These are important for producing a quality carbon credit with verifiability, additionality, and enforceability. The type and frequency of inventory information collected is important in order to verify the amount of annually sequestered carbon. Identifying who is responsible for the urban forest resource is important in establishing enforceability. Showing management of an urban forest resource addresses the issue of additionality, defined as a surplus of sequestered carbon above and beyond unmanaged forests or usual management.

The survey found that there is a supply of publicly owned urban trees. The respondents indicated that publicly owned trees included trees in the right-of-way, parks, government buildings’ grounds, reservoirs, stream and river buffers, airports, landfills, undeveloped industrial parks, and other lands. Table 1 shows the percentage of the different types of trees that make up the public urban forest.

Table 1. Trees included in the public urban forest

Percent Response	Publicly Owned Trees
94%	Along the street in the public right-of-way
94%	In parks
50%	Reservoirs, stream and/or river buffers
37%	Other (airports, landfills, undeveloped industrial parks)
88%	Other developed public land (e.g., City Hall or schools)
2%	Not sure

The amount of carbon sequestered by an offset project compared to the amount of carbon sequestered by a pre-project management is referred to as additionality. The criterion for determining additionality is currently subjective. The California Climate Action Reserve (2008) defines additionality as “a concept from international GHG project accounting principles that requires that a project activity would not have occurred in the absence of a market for GHG emission reductions.” The CCX (2008) on the other hand, does not provide a clear set of criteria for determining additionality. The CCX Rule Book Chapter ‘CCX Exchange Offsets and Exchange Early Action Credits’ does not mention any requirements such as those defined in the

California Climate Action Registry. However, the CCX does require that forestry offset projects be approved by the CCX Committee on Offsets. One could argue that carbon sequestered due to active management should count as additional to an alternative of no management. With regards to urban forest carbon sequestration, 37% of the survey respondents indicated that all of the urban forest resource was under an urban forest management plan. Of the urban forest resource partially covered under management plans, 85% covered street trees and 75% covered park trees.

Another important factor in producing a quality carbon offset is enforceability. Establishing who is responsible for the management of the resource provides recourse for non-fulfillment of a contract. Revisiting the carbon sequestration on the east face of the Rocky Mountains, there would be many different stakeholders. If the amount of carbon sequestered ended up less than the contract, then determining which stakeholder is liable would be difficult. With respect to urban forest carbon resource, 89% of the survey respondents identified an urban forester or arborists as the entity responsible for urban forest management.

In conjunction with establishing who is responsible for the urban forest, it is important to accurately determine the amount of carbon sequestered. This is a function of type and frequency of inventory. More than three quarters of the survey respondents indicated that they had either complete or partial inventories of the urban forest resource (Table 2). With regard to the frequency of inventories, more than three quarters of the survey respondent with inventories had completed those inventories within the past five years (Table 3). Not only are the majority of inventories recent, but more than half of the public urban forest resource will be inventoried again within the next 5 years (Table 4). The US Forest Service provides a software program, i-Tree 92008), that estimates the annual carbon sequestration for an urban forest. The researchers feel that i-Tree would provide a cost-effective means to estimate a city’s sequestered carbon. Of all respondents, 76% indicated they were familiar with the i-Tree program. In summary, most of the cities in the survey had complete or partial inventories that were recent and intended to re-inventory their respective urban forest resources in the next five years. The ready availability of inventory information and familiarity with the i-Tree program leads the researchers to the conclusion that many local governments could accurately and easily estimate their urban forest sequestered carbon.

In the second part of the survey, investigators wanted to gauge local governments’ interest in participating in an urban forest carbon market. The investigators asked about current local greenhouse gas initiatives and priorities. As questions became more specific, the number of “not sure” responses or omitted answers increased significantly.

Table 2. Type of inventory

Percent Response	Type of Inventory
56%	Partial or component inventory of public trees
22%	Covered part of the publicly owned trees
23%	None

Table 3. Date of last of inventory

Percent Response	Date of the Most Recent Inventory
52%	Within the last 2 years
26%	Between 2 to 5 years ago
12%	Between 6 to 10 years ago
10%	More than 10 years ago

Table 4. Date of next inventory

Percent Response	Date of Next Inventory
38%	Within the next 2 years
25%	In the next 2 to 5 years
4%	In the next 6 to 10 years
6%	Never
27%	Not sure

There are many initiatives to reduce greenhouse gas emissions. A little more than one third of the survey respondents indicated that reducing carbon emissions was a goal (Table 5). In contrast, only 17% indicated that, having considered the problem, reducing carbon emissions was not a goal.

With more than half of the respondents having discussed reducing carbon emissions (Table 5), the researchers wanted to look at the cities' exposure to carbon sequestration and/or trading. About three quarters of the survey respondents indicated that they were familiar at some level with carbon sequestration (Table 6).

Table 5. Reducing carbon emissions as a goal

Percent Response	Is Reducing Carbon Emissions a Goal?
26%	Yes, it is a priority
11%	Yes, but it is not a priority
17%	No, but it has been discussed
20%	No, but it has not been discussed
26%	Not sure

Table 6. Familiarity with carbon sequestration

Percent Response	Familiarity with Carbon Sequestration and/or Trading
12%	Very familiar
20%	Familiar
22%	Moderately familiar
18%	Somewhat familiar
16%	Not at all familiar
11%	Not sure

From the responses summarized in Tables 5 and 6, many cities are considering or are aware of carbon sequestration and/or trading. With regards to the established voluntary market in the U.S., only 21% of the respondents had heard of the Chicago Climate Exchange and only one local government of the 145 respondents are participants. The next step was to ask the level of interest in selling a city’s sequestered carbon in urban forests. This question elicited a very high “not sure” response because very few cities are participating in carbon trading and fewer still sell the sequestered carbon in urban forests. Of those with an opinion on selling their sequestered urban forest carbon, the majority answered they had interest in selling sequestered carbon (Table 7). Only 7% of the respondents indicated that they had no interest in selling the sequestered carbon in urban forests. Another question revealed that 25% of respondents indicated interest in using certified sequestered carbon as an offset to their own governments’ greenhouse emissions. Other questions concerning specifics of carbon trading, such as contract lengths, produced very high ‘not sure’ responses.

Table 7. Interest in selling sequestered carbon

Percent Response	Interest in Selling Certified Sequestered Carbon
10%	Very interested
10%	Interested
5%	Moderately interested
3%	Somewhat interested
7%	Not at all interested
64%	Not sure

Conclusions

The frequencies from the survey reveal that many local governments are interested in addressing climate change. Most cities have the inventory data available to accurately estimate the amount of sequestered carbon from their respective urban forests. Many of the local governments responded to the questions with “not sure”, reflecting uncertainty or lack of experience with aspects of carbon sequestration projects. As the questions in the survey became more abstract, such as expressing interest in selling certified sequestered carbon, the percentage of ‘not sure’ responses increased significantly. This soundly shows that many of the cities may not have formed firm opinions concerning climate change mitigation. Of the respondents who expressed opinions on the abstract questions, the majority of the responses were positive on the idea of selling a local government’s sequestered urban forest carbon resource. The researchers conclude that if the local governments were given more information on the specifics of selling sequestered urban forest carbon, more local governments would express interest in selling sequestered urban forest carbon in a market.

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