Carbon Storage in the Oyster River Community

Introduction

With the current carbon problem in the world it has now become even more important to understand the carbon cycle and how it impacts global as well as local communities. The point of the GLOBE carbon cycle is to educate people on their local ecology and how it is affected by local biomass and carbon storage within that biomass.[1] The following data was retrieved throughout forests in Durham, Lee, and Madbury in order to determine the biomass and eventually the carbon storage abilities of the Oyster River community.

As more and more technology is invented, more and more carbon is released into the air. According to many recent and ongoing studies, show that there is an increase in carbon in the atmosphere. The Keeling Curve[2] shows how over the past 50 years there has been an increase in global carbon storage in the atmosphere, most likely from unnatural human influence. A luxury of the Keeling Curve is that it shows carbon emissions throughout the seasons which directly relates to the ability of forests to trap carbon in trees.

The ability of trees to store carbon relates directly to the mission of the GLOBE carbon cycle. As carbon awareness and education continues to grow in communities throughout the world so does the confidence and ability to make eco-friendly decisions. With the skill to make environmentally smart choices, the possibility of lowering high carbon emissions becomes more readily available which helps to produce a healthier and

---

[1] GLOBE Carbon Cycle: *Background*
[2] http://earthguide.ucsd.edu/globalchange/keeling_curve/01.html

safer environment as well as lower economic impact on local business and families. Along with this, personal impact and conscience in the carbon problem can be corrected, creating a better place to live for future generations.

The study conducted included study plots throughout the Oyster River community. With the following data, it is possible to draw conclusions and discover how much carbon is stored in the local area by entering the data into a Jenkins program created of allometric equations[3]. This allows for the age of the forest to be found and to decide if the local ecology is a sink, a source, or at steady state in relationship to the GLOBE carbon cycle. The drawn conclusions let the Oyster River community know more about their local forests and what is needed to be done in order to sustain a healthy environment.

Methods

In the field, many 10 meter by 10 meter study plots were set up in the Oyster River community. Four study plots were established in Durham (two in Oyster River Natural Area – old road and old foundation -, one on Stagecoach Road, one in the University of New Hampshire's College Woods), two study plots in Lee (one on Riverside Farm Drive, one on the Lamprey River), four study plots in Madbury (one on Hayes Road, one in Kingman Farm, one on Hayes Hill, one at the Madbury Reservoir canoe drop on Route 9), with a total of ten study plots. Using a tape meter, the *diameter at breast height* or *DBH* of the trees was measured. *DBH* is a measurement of the tree trunk's diameter at 1.35 meters above the ground. *DBH* can be used as an accurate

---

[3] Jenkins, J.C., D.C. Chojnacky, L.S. Heath and R.A. Birdsey. 2003. A comprehensive database of biomass equations for North American tree species. USDA Forest Service General Technical Report NE.

representation of the average size/diameter of the tree.[4] Along with gathering the *DBH*'s, the species was noted for each tree within the 10 meter by 10 meter study plot.

Back in the lab, following the onscreen instructions, the *DBH*'s as well as the species were entered into a Jenkins computer program created by GLOBE Carbon Cycle. The program is made up of allometric equations which allow for easy calculation of the 10 meter by 10 meter study plot's biomass and ultimately the total carbon storage for designated plot.

Results

Data Table 1:

Study Plot	**Total Aboveground Biomass (g/m^2)**
Durham – ORNA	17185
Durham – ORNA – old foundation	14603
Durham – Stagecoach Road	6128
Durham – UNH's College Woods	12073
Lee – Riverside Farm Drive	8402
Lee – Lamprey River	8248
Madbury – Hayes Road	32210
Madbury – Kingman Farm	13533
Madbury – Hayes Hill	54511
Madbury – Reservoir	34937

Data Table 2:

Study Plot	**Total Aboveground Carbon (g/m^2)**
Durham – ORNA	7733
Durham – ORNA – old foundation	6571
Durham – Stagecoach Road	2757
Durham – UNH's College Woods	5433
Lee – Riverside Farm Drive	3781
Lee – Lamprey River	3712
Madbury – Hayes Road	14495
Madbury – Kingman Farm	6090
Madbury – Hayes Hill	24530
Madbury – Reservoir	15722

[4] GLOBE Carbon Cycle: *Tree Data Collection*

The above tables represent a compilation of all the collected allometric equation data. The data in the tables is based off of the *DBH* values and tree species collected at the field study plots.

Data Table 1 displays the total aboveground biomasses for the study plots. At 54511 g/m^2, the Madbury – Hayes Hill plot has the largest biomass. The Durham – Stagecoach Road study plot has the smallest biomass at 6128 g/m^2. Data Table 1 allows for all of the aboveground biomass data to be compared in the same table which makes it easier for conclusions to be drawn.

Data Table 2 displays the total aboveground carbon for the study plots. Just like in Data Table 1, the Madbury – Hayes Hill study plot has the largest carbon at a value of 24530 g/m^2. At 2757 g/m^2, the Durham – Stagecoach Road study plot has the smallest carbon value. Since both the Hayes Hill and the Stagecoach Road plots have the largest and smallest values in both Data Table 1 and Data Table 2 it is possible to conclude that the tree species and characteristics in all of the study plots directly relate to the current allometric equation values.

Discussion

In order to understand the carbon storage abilities of the Oyster River community forests, the average of the total aboveground biomass values is needed. Also, after examining the collected data it is possible to use unique study plot characteristics to determine why some study plots and forests differ from site to site.

The collected data from the study plots directly relate to the overall purpose of this study. While each individual study plot differs in value in both the total aboveground carbon and total aboveground biomass tables, it doesn't mean that the examined area is unhealthy or incorrect. For the most part, the study plots jive with each other, the exception being the Madbury – Hayes Hill and Durham – Stagecoach Road study plots. In both studies/data tables, the Madbury – Hayes Hill study plot produced the largest value which was much greater than the next highest valued study plot. 54511 g/m^2 was the value for Hayes Hill in the total aboveground biomass table which is 20000 g/m^2 greater than the Madbury – Reservoir study plot which comes is the next highest study plot with a value of 34937 g/m^2. In the total aboveground carbon table, Hayes Hill has a value of 24530 g/m^2 which is 9000 g/m^2 more than the next highest value, being once again the Madbury – Reservoir with a value of 15722 g/m^2. The total aboveground biomass value for the Stagecoach Road study plot is 6128 g/m^2 which is 2000 g/m^2 lower than the Lee – Lamprey River study plot which is the next lowest with a value of 8248 g/m^2. In the total aboveground carbon table, the Stagecoach Road study plot is also the lowest value. Stagecoach Road has a value of 2757 g/m^2 which is 1000 g/m^2 lower than the next lowest study plot, being Lamprey River with a value of 3712 g/m^2.

Both the Hayes Hill and Stagecoach Road study plots can be considered outliers when averaging the data. When at both of these study plots, there was a noticeable difference. Unlike the other study plots which have a variety of species of trees, the Hayes Hill and Stagecoach Road plots are dominated by one species of tree. The Hayes Hill study plot has only large mixed hardwoods while the Stagecoach Road plot has almost nothing but white pine. The Hayes Hill study plot is located in a dry, elevated area which is where hardwoods thrive. The Stagecoach Road study plot is located in a low, swampy area which is where white pines do the best. With these observations, it makes sense that in both data tables, the Hayes Hill and Stagecoach Road study plots are the largest and smallest values, respectively. This also shows that the mixed hardwoods are superior to that of their softwooded counterpart white pines when it comes to carbon storage. With this in mind and since hardwoods can store much more carbon than softwoods, it makes sense that the planting of mixed hardwoods in the Oyster River community would help to create a longer termed solution to the current global carbon problem.

The average of the total aboveground biomass is 9082.4 g/m^2. This number is important in evaluating the storage capacity of the entire Oyster River community. Since the sites were located throughout Oyster River, the averaged value of 9082.4 g/m^2 is an accurate representation of the amount of carbon stored throughout Oyster River forests. In a global model produced by Whitaker[5], a forest with the same characteristics and turnover rate to that of the Oyster River area, is at steady state around 22000 g/m^2. However, this model can not accurately represent just the Oyster River community and the Seacoast region of New Hampshire. By following the Whitaker model, the local forest wouldn't even be half way to full capacity and would be around ten-years in age. Although it is not possible to determine the exact age by relying on just the *DBH's* of the trees, it is possible to conclude by using the sizes of the collected *DBH's* that the trees and therefore the forest is much older than ten-years. This proves that the Whitaker model, while accurate on a global scale, is an inaccurate representation of forests on a smaller community size based study.

Knowing the carbon storage abilities and characteristics of the Oyster River community forests is very important to the members of the community. This

---

[5] GLOBE Carbon Cycle: *How does Net Primary Productivity vary globally in response to variation in average annual temperature or average annual precipitation?*

information allows for the Oyster River community to know what local forests are still growing and how these forests can be bases for local solutions to the current global carbon problem.