Carbon sequestration as part of the global warming solution – Using software to combine environmental stewardship with economic benefit

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ABSTRACT
The purpose of this paper is to provide an overview of what carbon sequestration is, how forests are used as natural carbon sinks and how selling carbon credits is proving to be a potentially new revenue stream for organizations and other entities managing large tracks of forested area. Finally, this paper will show how Remsoft's spatial planning and modeling software system enables efficient and effective management of forests as carbon sinks.

Key words: carbon sequestration, carbon credits, carbon trading, forestry, forests as carbon sinks, spatial planning and modeling software, Remsoft

Résumé
Le but de ce document est de fournir un aperçu de ce qu'est le piégeage du carbone, de la façon dont on utilise les forêts comme puits naturels de carbone et de la façon dont la vente de crédits de carbone s'avère être une source de revenus potentiellement nouvelle pour les organismes et d'autres entités qui gèrent de vastes sillons de régions boisées. Enfin, ce document montrera de quelle façon le système logiciel de planification et de modélisation spatiale de Remsoft permet une gestion rentable et efficace des forêts comme puits à carbone.

Mots clés : piégeage du carbone, crédits de carbone, échange de droits d'émission de carbone, foresterie, les forêts comme puits de carbone, logiciel de planification et de modélisation spatiale, Remsoft

Introduction

Masterful carbon sequestration, whether to meet self-imposed guidelines or those agreed to in efforts like the Kyoto Protocol, is both an art and a science. Forestry managers who are adept at large-scale spatial planning can use this knowledge to dramatically influence the health of the planet and aid their organizations—or even countries—in generating new revenue streams created through buying and selling carbon emissions rights. Using spatial planning software that models predicted results based on hypothetical scenarios greatly improves the managers' accuracy while saving time.

Why Carbon Sequestration

According to the United States Department of Energy Office of Science, atmospheric levels of carbon dioxide (CO_2) have risen from pre-industrial levels of 280 parts per million (ppm) to present levels of 375 ppm. Evidence suggests this observed rise in atmospheric CO_2 levels is due primarily to expanding use of fossil fuels for energy. Predictions of global energy use in the next century suggest a continued increase in carbon emissions and rising concentrations of CO_2 in the atmosphere unless major changes are made in the way energy is produced and used—in particular, how carbon is managed. One way to manage carbon is through sequestration (United States Department of Energy Office of Science [undated]).

Carbon sequestration describes processes that remove carbon dioxide from the atmosphere and sequester it to long-term storage in the terrestrial biosphere, underground or in the oceans to help mitigate the effects of CO_2 on global warming. A variety of natural and synthetic means of capturing and storing carbon is now under exploration. These include enhancing the natural terrestrial cycle—planting and managing forests and other large-scale vegetation growth for maximum carbon absorption (National Energy Technology Laboratory [undated]).

What this and other methods have in common is that they involve storing CO_2 in what is called a carbon sink. A carbon dioxide sink is a carbon reservoir that increases in size and is the opposite of a carbon dioxide source. Recognized natural sinks are (1) the oceans and (2) plants and other organisms that use photosynthesis to remove carbon from the atmosphere (United State Department of Energy Fossil Energy Office of Communications [undated]). The concept of CO_2 sinks has become more widely known because the Kyoto Protocol allows for the use of carbon dioxide sinks as a form of carbon offset.

Forests as Carbon Sinks

Of interest here is the use of forests as carbon sinks. Forests and other areas of vegetation sequester carbon from the atmosphere as they grow, and forests act as an important store of carbon even when they have reached maturity and are not increasing in size. Sequestrated carbon in eligible new forests can be used to create carbon credits for sale to organizations or individuals who are looking to offset some of their carbon emissions.

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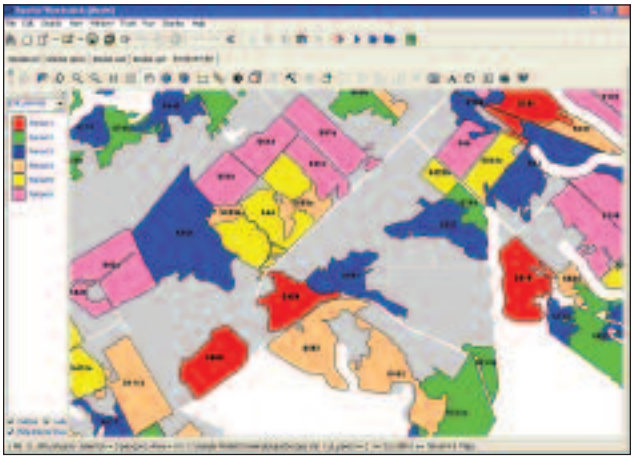
Dr. Nick O'Brien in the field.

An example of a screen view from the Remsoft System.



A modeling example from the Remsoft System, Spatial Woodstock/Stanley.

In the future, it may also be possible to create carbon credits by changing management to increase the sequestration rate of existing forests, or protecting existing forests that are under threat of deforestation. Although the best way to reduce carbon dioxide emissions is to reduce the use of fossil fuels, using carbon credits from forestry can contribute to emissions reductions while low emission energy sources are developed.

Because growing vegetation absorbs CO_2, the Kyoto Protocol allows countries that have large areas of forest (or other vegetation) to deduct a certain amount from their total emissions, thus making it easier to achieve the desired net emission levels (Wikipedia [undated]).

Note that the global cooling effect of carbon sequestration by forests is partially counterbalanced. For example, planting new forests may initially be a source of carbon dioxide emission when carbon from the soil is released into the atmosphere. Also, reforestation can decrease the reflection of sunlight. For example, mid-to-high latitude forests have lower levels of reflected sunlight during snow seasons than flat ground, so they contribute to warming (Oregon Wild [undated]). These factors can be accounted for and accommodated in a carbon sequestration plan via software modeling. However, in addition to the overall global cooling effect of reforestation, planting forests reduces erosion, increases water capture and provides valuable timber that can be sustainably harvested.

Forestry Carbon Credits Can Provide New Revenue Streams

Carbon credits are a tradable commodity, and are generally equal to 1 metric ton (2205 pounds) of carbon dioxide. In placing a price on the carbon stored in forests, managers are motivated to consider the environmental benefit that the forest provides in determining what management action to take (Carbon Solutions Group [undated]).

Carbon credits are generated in two ways. One, projects that reduce greenhouse gas emissions can generate carbon offsets, which are sold to entities that wish to purchase emissions abatement. Buyers are motivated by regulatory and voluntary drivers. Two, under a regulatory emissions reduction scheme, entities are given emission allocations up to a total scheme cap. Entities that emit less than their allowance can sell remaining allocation to other regulated entities. This is the structure of the European Union (EU) Emissions Trading Scheme, by far the largest carbon market in the world. Forestry-based credits are currently not allowed in the EU Scheme (Carbon Solutions Group [undated], Kollmuss and Bowell 2006).

International treaties such as the Kyoto Protocol set quotas on the amount of greenhouse gases countries can produce. Countries, in turn, set quotas on the emissions of businesses. Businesses that are over their quotas must buy carbon credits for their excess emissions to avoid paying taxes on excesses, while businesses that are below their quotas can sell their remaining credits. By allowing credits to be bought and sold, a business for which reducing its emissions would be expensive or prohibitive can pay another business to make the reductions for it.

Carbon credits can be exchanged between businesses or bought and sold in international markets in the same way that stocks and commodities are bought and sold. There are currently three exchanges for carbon credits: the Chicago Climate Exchange (CCX), the European Climate Exchange (ECX), and the Asia Climate Exchange (ACX) (Manguiat *et al.* 2005).

As reported in the *International Herald Tribune,* the rapid emergence of carbon finance in London (and elsewhere)—not only trading carbon allowances but investments in projects that help generate additional credits—is largely the result of the decision by European governments to start capping amounts that industries emit (Kanter 2007). The *International Herald Tribune* quotes Chris Leeds, the head of emissions trading at Merrill Lynch in London, as saying carbon could become "one of the fasting-growing markets ever, with volumes comparable to credit derivatives inside of a decade."

New Forests Pty, Ltd. is one of the new breed of forestry companies specializing in the emerging markets for carbon credits and complementary forest-based ecosystem services arising from sustainable forest management. Based in Australia, New Forests' clients and management span the globe, including Australia, New Zealand, the United States and the Asia-pacific region (Remsoft, Inc. [undated]). Elements of New Forests' business model include identifying forest land investment opportunities, quantifying the carbon sequestration capacity and creating offset certificates for sale to CO_2 producers that have regulatory or voluntary reduction obligations.

"In addition to the traditional timber and land values, the forests' ability to remove and store carbon dioxide from the atmosphere is a potential new revenue stream for forest land owners, and because greenhouse gas emissions are increasingly being regulated there is a ready market for the carbon credits," says Dr. Nick O'Brien, New Forests' director of resource management systems. "Carbon trading is new and it is not widely understood, but it is an effective way to enable businesses and nations to reduce greenhouse gas emissions," O'Brien says. "There is a strong incentive to plant new forests, to minimize deforestation and to convert some agriculture land back to forested areas; it is very positive for the environment and has a positive financial outcome as well."

Using the Latest Technology to Manage Carbon Sequestration in Forests

The ability to use technology to formulate models as either simulation or linear programming models makes effective and efficient forestry and carbon sequestration management possible. Software permits a choice of model formulations where optimization via linear programming enables forest managers to find the best possible solution. Simulation via modeling enables forest managers to test "what-if" scenarios, including simulations to factor random events into long-term management planning. The most useful applications have the capability to model planning goals and determine the best solution via language that provides users the ability to replicate problems in a way that matches their perception of the challenge (Walker 2005).

O'Brien is a forester by profession. He creates long-term, spatial forest management plans for New Forests properties—including setting treatment and harvest schedules, valuing lands for purchase or sale, spatially verifying operating plans and more. O'Brien is quick to recognize the inherent benefits of using the latest technologies for assessing the carbon capacity of forest assets and to consider these values vis-à-vis other values like timber production (Remsoft, Inc. 2007).

"Optimization technology means you can get the best possible answer given certain constraints and that is precisely what we need to do in assessing a forest's carbon sequestration potential" O'Brien says. "In fact, with the Remsoft Planning System we incorporate both carbon and timber values in our models and optimize both at the same time then work out the optimal values of the resources. In some cases, harvesting the timber is more valuable and in others treating it and letting it stand is. The point is we have the tools to determine this definitively."

All inputs, outputs, actions, attributes and values would be user-defined to allow for specific data entry resulting in unique analyses and reporting.

Summary

The world has come to recognize the realities of excess CO_2 emissions and their effects on global warming as such emissions have increased dramatically in the decades following the industrial revolution. Forward-thinking countries and entities around the world have taken steps toward addressing and abating the issue by instituting CO_2 reduction agreements under several pacts, with the Kyoto Protocol standing out as the best recognized effort. This has led to a search for both natural and synthetic ways to reduce carbon emissions and for ways to store what cannot be reduced via processes collectively called carbon sequestration. These stores are called carbon sinks.

Currently, the Kyoto Protocol recognizes afforestation and reforestation carbon sequestration among other methods for generating carbon credits that can be sold and bought for the purpose of meeting carbon emissions quotas or obligations. The tactical processes of maintaining forests and other large vegetation tracts for the purpose of carbon sequestration is made easier, more efficient and more effective via the use of the latest technologies now available.

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