The Role of Biological Carbon Sinks in Ameliorating Global Climate Change

Patrick F. Noonan and John G. Rogers

Introduction

The amount of carbon dioxide emitted from fossil energy consumption in the United States has risen steadily through the last decade. The Energy Information Administration of the U.S. Department of Energy estimates that the total emissions of carbon dioxide from fossil fuel combustion reached 1,906 million metric tons of carbon in the year 2000. This is up 2.5 percent from 1999 and 15.4 percent from 1990. This rise is unequivocal and unquestioned, but the implications of these data to global warming and climate change and resultant national policies are less certain and subject to argument. With the disagreement on the nature and extent of effects on climate, it is no surprise that appropriate remedies, if any, are equally at issue.

A number of nations have accepted that there is a problem and agreed at Bonn to implement actions to curb the emission of carbon dioxide from combustion of fossil fuels. The United States has elected to withdraw from the Kyoto process, taking the position that the remedies agreed upon by the parties would have too great an impact upon the U.S. economy and may place it at a competi-

Patrick F. Noonan is Chairman and John G. Rogers a Senior Fellow of The Conservation Fund.

tive disadvantage with other nations. Nevertheless, many U.S. businesses that emit carbon operate in a global economy and will be faced with the necessity to act or potentially lose their ability to compete in the world market. Others are stepping forward as good corporate citizens, or believe that some form of carbon constrained environment in the U.S. is inevitable in the future and are taking steps to offset their carbon dioxide emissions through a number of means. One of the most attractive practices in this regard, and one recently recognized in the implementing procedures for the Kyoto Protocol,is through management of terrestrial carbon sinks (herein referred to as carbon sequestration).

Carbon Sequestration

Carbon sequestration, as an action to mitigate carbon dioxide emissions, takes advantage of the fact that as plants grow they incorporate carbon from the atmosphere into their structure through the process of photosynthesis. The carbon is bound within the plant tissue until the plant, or product derived from plant tissue, burns or decays, once again releasing the carbon into the atmosphere as carbon dioxide. Thus, as a carbon mitigating policy and practice, carbon sequestration takes the form of encouraging plant growth (usually trees) in areas where they are not currently growing, or where they can be made to grow more efficiently. At maturity, tree growth slows as does the rate of carbon uptake, and they reach a dynamic equilibrium with their environment where the amount of carbon sequestered per acre fluctuates around some average as a result of management actions or environmental influences. Emerging research has indicated that on good sites more than 400 tons of carbon dioxide equivalent can be sequestered per acre after 70 years.

Though it has been the subject of international disagreement,the use of carbon sequestration was recently legitimized in the Kyoto Protocol and it may now become an attractive component of companies' (and nations') overall carbon management portfolios. A recent report from the Royal Society of Britain indicated that carbon sequestration from changes in agriculture and forestry practices can potentially achieve 25 percent of the reductions in carbon dioxide that will be required globally by 2050 to avoid large increases in temperature. They believe that to achieve this magnitude of carbon uptake would take considerable political will and that there is little potential to go further. The Society concludes that overall the amount of carbon that can be sequestered through land manage-

ment practices is finite in size and duration, and that such projects should not divert nations from the overall goal of reducing consumption, increasing efficiency, and sequestration at the source. However, although carbon sequestration may not be the panacea on a global or national scale,it can be an important part of a company's or a nation's overall carbon management plan and can amount to 20 percent of the effort.

Carbon sequestration through forestry activities has a number of advantages that make it attractive to an emitter wishing to develop and implement a suite of carbon dioxide-mitigating practices. First,it is relatively cheap and by the end of a project's life span can sequester carbon for considerably less than $10 per ton. (The principal variable is the cost of land). Second, it provides public benefits beyond carbon sequestration (i.e. wildlife and fish habitat, enhanced water quality, flood protection, and outdoor recreation). Third, if handled sensitively and carefully, lands acquired and restored comprise an appreciable asset that could be put to another use in the future if conditions change. Fourth, but importantly, carbon sequestration projects are not individually controversial, and because of their other benefits can reflect favorably on the company taking the action.

A number of non-profit conservation organizations, including The Conservation Fund (TCF), have begun to work with companies to facilitate their efforts to implement projects designed to sequester carbon. Building upon its strength in designing market-based approaches to land conservation, TCF has instituted a program in partnership with several organizations to demonstrate that land conservation and carbon sequestration are compatible and achieve public benefits beyond what any of the partners could have done acting on its own. One such project is described later in this paper.

Considerations for Project Implementation

Companies considering whether and how to offset their carbon dioxide emissions face a confusing regulatory and legal environment where the easiest response is to do nothing until the situation is clearer. Currently there is no Federal regulation dealing with carbon dioxide as a pollutant, and there is not likely to be a mandatory requirement in the immediate future. Whether or not some sort of a voluntary program is instituted, and what the requirements for crediting might be, remain to be seen. Furthermore,states are acting independ-

ently in approaching regulation of carbon dioxide emissions. At this time only two states (Massachusetts and Oregon) have regulations requiring offsets to carbon dioxide emissions from power plants consuming fossil fuel. Additionally, rules governing the assignment of credit for early actions in the carbon dioxide management arena have not been officially adopted, adding further to the tendency for paralysis. We believe a unique opportunity exists during the present U.S. policy uncertainty to initiate joint venture partnerships among the nonprofit, private, and government sectors to test sequestration projects as a means of achieving multiple natural resource conservation objectives.

A number of nations participating in the Kyoto Protocol believed that it was important to include land use,land use change, and forestry activities as permissible actions to take in limiting greenhouse gas emissions. The role of these activities and whether and how they would be included in the Protocol was the subject of complex and difficult negotiations throughout the process. Though they were included in the final protocol, significant controversy still surrounds issues of implementation. Thus it is important for voluntary actions in the United States to address the critical questions that can arise during implementation.

The three important issues that must be addressed in the planning and implementation phase of a carbon sequestration project are the concepts of leakage, additionality and permanence. Leakage refers to the potential of a project to merely displace an activity from one location to another. That is, a reforestation project occurring on agricultural land must demonstrate that removing those lands from agricultural production does not stimulate the clearing of forest elsewhere for an activity similar to that previously occurring on the reforested land.

Additionality addresses the necessity for the project to demonstrate that the activity claimed in carbon sequestration is additional to what would have occurred in the absence of the project. Reforestation projects must demonstrate that they are reestablishing forest cover on lands that would not have otherwise been actively reforested by their owners or passively through natural processes.

Since human actions are potentially reversible, the concept of permanence is important. The project must incorporate steps that will lead to its becoming an enduring part of the landscape. Such issues as long-term management by a qualified entity, management planning, and project accounting are activities

that can help assure the permanence of the project. It is crucial that all projects include a plan for monitoring and allow for independent verification of benefits claimed from a project.

The credibility of projects rests upon how we deal with the above issues. In an effort to incorporate those concepts and to encourage companies to undertake early carbon sequestration projects (aimed specifically at the Mississippi Delta), a number of representatives from a diverse array of governmental, non-governmental, and business organizations (with leadership provided by The Conservation Fund) have worked to exchange ideas on the interplay among ecosystem restoration, carbon sequestration, and forestry. Business representatives note that the lack of certainty as to what kinds of activities are likely to produce carbon credits, should a formal program of carbon crediting be adopted in the future, is a significant barrier to increased participation in land-based projects designed to sequester carbon from the atmosphere. The participants agreed that if projects subscribed to a set of principles that were simple, logical, and defensible, project credibility would increase. Subsequently, such credible projects could be supported by state and Federal agencies when an application for carbon credit is made. In addition to supporting the overall environmental benefits of carbon sequestration projects, the principles are designed to support claims that such projects are permanent, additional to what might otherwise have occurred without the project, and do not merely displace the previous activity. The effort to develop and refine the principles is not complete;the principles currently agreed upon follow:

1. The project is designed to restore fully-functioning natural systems.

2. The project does not displace a productive land use activity, and is undertaken on lands that were cleared of their forest cover prior to 1990 (the date of the Rio Framework Convention) and converted to other uses that proved marginally productive.

3. The project results in additional carbon capture compared to that which would otherwise have occurred.

4. The project reflects efforts to withstand natural and human-induced threats to its permanence.

5. The project establishes a carbon baseline and a defined monitoring system so that carbon dioxide removals can be independently verified.

6. The project is reported to the Energy Information Administration of the U.S. Department of Energy under a provision of the 1992 Energy Policy Act designed to account for the voluntary reporting of emissions and reductions of emissions of greenhouse gases.

7. The project provides demonstrable long-term management by a qualified entity to ensure the full range of benefits.

8. A project plan incorporates the above principles.

The emphasis on restoring natural systems is intentional, and embodies the tenet that projects that are designed to sequester carbon should not simply replace one kind of pollution with another. The laudable purpose of removing carbon dioxide from the atmosphere through carbon sequestration should not be compromised by projects that serve as stimuli for planting monocultures of fast-growing exotic species, or monocultures of any other species planted solely for carbon management. This principle obviously would not preclude attempts to reestablish systems dominated by a single tree species (e.g. longleaf pine, ponderosa pine). A natural system that rebuilds and maintains an optimum level of organic carbon is a more sustainable,higher quality system capable of providing a broader range of environmental benefits than an artificial one.

The Conservation Fund, with its partners, has recently implemented a demonstration project that conforms to these principles. A brief review of that project will serve to illustrate how these multiple objectives can be accomplished. American Electric Power (AEP) is one of the nation's largest consumers of coal, and as such is a major carbon dioxide emitter. That company decided to undertake a series of actions to offset some of its emissions by joining a partnership with The Conservation Fund, Environmental Synergy, Inc. (ESI), and the U.S. Fish and Wildlife Service to undertake the largest carbon sequestration project yet implemented in the U.S.

In this project, The Conservation Fund acquired 18,372 acres of marginal agricultural land from the Tensas Delta Land Co. The Fund in turn conveyed

10,257 of these acres to AEP and 8,115 acres to the Fish and Wildlife Service. AEP, acting through ESI, is restoring bottomland hardwood habitat by planting native tree species on its property and a portion of that owned by the Service. The entire 18,372 acres will be managed by the Fish and Wildlife Service as part of the Catahoula National Wildlife Refuge in Louisiana. It is expected to sequester more than 4,100,000 U.S. tons of carbon dioxide (3.4 million metric tons) over its 70 year span at a cost of $1.55 per U.S. ton. The Conservation Fund has implemented a similar project with Texaco, Inc.and is in partnership with several other companies to help them fulfill their wishes to undertake early actions to offset carbon dioxide emissions.

The Conservation Fund, with its partners, is carrying out a full-service carbon sequestration program with industrial firms to achieve the multiple goals of carbon sequestration, enhancement of fish and wildlife habitat, protection of water quality, increasing flood storage,and increasing the area available for public outdoor recreation. As currently designed,this carbon sequestration program provides a new source of conservation capital to advance America's land and water conservation agenda while improving air quality. The latest results from the creation of carbon sinks are promising and represent an important contribution to ameliorating global climate change.

Emerging Issues

The history of carbon sequestration through projects such as that described above is relatively short. Nevertheless,as innovators accumulate experience, policy questions are emerging. First among these is the extent to which agroforestry activities should be encouraged and credited, in contrast to the approach taken here. Single species plantations can undoubtedly sequester more carbon at a higher rate, but they may not carry the concomitant other environmental benefits that are described here. To what extent should these important other benefits be taken into account in determining what projects should be undertaken and how should they be credited? Should government be involved in establishing policies that encourage one choice of project type over another?

The question of time is frequently raised as a limitation to carbon sequestration projects as described here. Some will argue that project life is limited to the lifetime of the tree species involved. Though management of growing or mature

forests can extend the useful life of biological sequestration projects, the forests cannot continue to increase the amount of carbon stored in them. It is argued that alternative fuels, energy conservation, and technological solutions are more permanent and should be preferred to the temporally limited projects. Frequently lost in the discussion is the fact that we understand how to plant trees, and their growth is automatic with reasonable stewardship. However, we currently do not have the technology or political will to accomplish many other actions.

As previously mentioned, carbon sequestration projects are not individually controversial. Nevertheless, some argue that crediting the relatively inexpensive carbon offsets derived from carbon sequestration may serve to divert efforts from developing technology or alternatives that prevent emissions in the first place. They further argue that projects such a those described here merely recycle carbon within the biosphere rather than keeping it within or returning it to the geosphere. Those arguments notwithstanding, biological carbon sequestration can play an important early role in mitigating emissions as long as there is a clear understanding that to fully and finally solve the underlying problem of global climate change will require a fundamental shift in the way that energy is produced and used.

Other policy issues, not specific to carbon sequestration but generic to carbon management, will also influence the nature and extent of carbon sequestration activity. As projects will be dealing with biological systems with their inherent variability, how will project accounting and auditing be handled and independently verified, and what will the "rules" be? Most U.S. actions are voluntary at this time. Will the voluntary program be formalized, and what entity will keep the "official" records? And, importantly, will there be an officially sanctioned market in this country for carbon offsets? The future of carbon sequestration as a carbon-management activity in the U.S. will depend on how each of these issues is addressed.

Conclusion

Carbon dioxide concentrations in the atmosphere are increasing, and there is strong evidence that this is contributing to global climate change. Concerted action by all to reduce or offset carbon dioxide emissions is going to be required to reverse or stabilize this trend. Carbon sequestration through reforesting mar-

ginal agricultural lands is increasingly being seen as one alternative. While not constituting a panacea to cure all the problems, carbon sequestration, like balance in an investor's portfolio, can be an important component of a company's carbon management plan. It can help mitigate marginal increases and can provide other important environmental benefits while at the same time constituting an asset for the future.

Corporate/non-profit partnerships as described in the TCF/AEP example can be productive for the country and provide a competitive advantage for the corporate partner. Through such partnerships the project can be completed at lower cost, the risk can be spread and insured against, chances for a long-term public steward of the lands in the project are enhanced, the chances of credit for early action are increased, and public recognition of the company's action is heightened.

The ultimate solutions to the problem of carbon dioxide and other greenhouse gases accumulating in the atmosphere lie in large part in the arena of technology. Yet, at a relatively low cost per ton of carbon, carbon sequestration can play an important role in long-term carbon management, and it can be started quickly. Though brief in geological time, the 60-70 year life of carbon sequestration projects can help provide a wider window of opportunity in which to develop technological approaches to atmospheric carbon reduction. At the same time carbon sequestration projects can make permanent contributions to water quality, fish and wildlife habitat, and outdoor recreation. Today carbon sinks represent a potential source of new conservation capital to achieve multiple air, land, and water conservation benefits.