PERSPECTIVE

Mitigating Climate Change with Managed Forests: Balancing Expectations, Opportunity, and Risk

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The forestry community is abuzz with anticipation regarding how managed forests will be able to participate in emerging markets for carbon offsets. Carbon markets may in the future offer some potential for compensating forest landowners for actions that demonstrably reduce the atmospheric CO^2 burden. Foresters, however, must recognize that not all forms of enlightened forest management can, or should, qualify for credits. We caution that in the exuberance to take advantage of new, imperfectly formed cap-and-trade markets (e.g., Chicago Climate Exchange, California Climate Action Registry, and Regional Greenhouse Gas Initiative), some managed forest projects may prove to confer no real climate benefit, owing to leakage or lack of additionality. Indeed, questions surrounding the credibility of certain cap-and-trade projects already being implemented in nonforestry sectors under the Clean Development Mechanism of the Kyoto Protocol may be placing this approach in jeopardy (Bell 2008).

Forestry projects can influence CO_2 sequestration in essentially three ways: (i) by creating new forests (afforestation), (ii) by avoiding their destruction (avoided deforestation), and (iii) by manipulating existing forest cover (managed forests). Land-use change, specifically deforestation and regrowth, are by far the biggest players, globally, in terms of forests acting as sources or sinks for CO_2, respectively (Intergovernmental Panel on Climate Change [IPCC] 2000). Projects that create forests are the least controversial in terms of qualification for credits because they have the potential to sequester relatively large amounts of carbon and are fairly easy to quantify and monitor.

Realistically, opportunities for afforestation projects here in the United States are limited. This may help explain the growing momentum to include "sustainably" managed forests (e.g., Ruddell et al. 2007) that incorporate silvicultural activities such as extended rotations, structural retention, promoting full stocking and vigor, and lowering vulnerability to catastrophic losses. If implemented effectively, these approaches have the potential to increase the amount of sequestered carbon relative to the background condition (e.g., business-as-usual [BAU]) that provides the reference (baseline) against which offsets accrue (additionality). However, extending rotations on ownerships participating in cap-and-trade could also lead to tightening supply and stimulate harvests elsewhere, potentially canceling those gains (leakage). A recent example of this type of unintended consequence is provided by increased tropical deforestation in response to domestic biofuel production initiatives (Laurance 2007).

Holistic assessments of forest management scenarios incorporating product life cycles (i.e., carbon stored in wood products and landfills and biomass energy) and direct substitution for more energy-intensive building materials (e.g., concrete and steel) suggest active management can be carbon neutral or may even represent a substantial net sink for atmospheric carbon (Perez-Garcia et al. 2005, Miner and Perez-Garcia 2007). Intensive management and short rotations appear to maximize such benefits effectively by increasing the rate of substitution, not by storing more carbon in forests (Perez-Garcia et al. 2005). However, such scenarios potentially conflict with the "permanence" tenant required of carbon offsets under cap-and-trade. Moreover, absent the substitution effect (but accounting for storage), intensive approaches do not appear to compare favorably with more passive management in terms of sequestration potential (Harmon et al. 1990, Perez-Garcia et al. 2005). The reasons for this have to do variously with the interactions among storage and uptake rates (Harmon et al. 1990), basic production ecology (Long et al. 2004), conversion efficiencies from trees to wood products, fuel emissions from wood harvesting and transportation to mills and distributors, and the dynamics of long-term storage (Smith et al. 2006).

If climate benefits from managed forests rely heavily on the substitution of wood for more energy-intensive alternatives, then cap-and-trade may not be the best approach for promoting this shift. An alternative policy, e.g., a short-term direct subsidy until a robust market develops, might be a better alternative. If interested parties are concerned about the cost of tracking the marginal benefits of improved forest management relative to BAU, imagine the additional layer of complexity required to verify that wood products originating from a given ownership are actually being substituted for less desirable materials. In addition, owing to the focus on additionality, cap-and-trade inherently favors rates of uptake as opposed to storage—arguably one of forestry's strongest suits. This could have the perverse consequence of putting those who have managed their lands aggressively in the past at a distinct advantage because of lower stocking and thus potential for additional uptake, while providing limited opportunities for ownerships that have maintained high carbon density forests all along.

Forestry can ill afford further deterioration of its public image. The climate change issue is very much in the public eye. Foresters must identify and support true win–win scenarios in which forests can contribute meaningfully to climate change mitigation; however, there is little scientific justification for promoting all projects that involve forestry. Furthermore, we need to keep in mind that cap-and-trade is widely viewed as a short-term stop-gap measure to "buy time" until technologies develop to dramatically reduce greenhouse gas emissions. Limited will and resources exist with which to address this problem, and

given the primarily negative consequences of global climate change (IPCC 2007), the responsible thing to do is to focus on strategies most likely to provide short-term benefits. If a robust definition for additionality can be developed and compensation is tied to tangible climate benefits (including addressing leakage issues), then managed forests can participate in carbon offset markets with confidence.

Like all foresters, we recognize the multiple benefits to society of forests as a renewable resource when managed skillfully. Forestry deserves to compete (and be provided with similar levels of assistance that other "green" technologies are receiving) for a prominent role in a future that is less reliant on fossil fuels. Recent scenario analyses have shown that no single emissions-offset technology is going to solve the climate crisis (e.g., Pacala and Socolow 2004). What is needed are a wide range of approaches with various degrees of "readiness" that function over various temporal scales. It is time for the forestry community to critically examine key questions regarding how managed forests will participate in the national cap-and-trade policy likely to develop in the near future.

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