Study reveals potential to amass more carbon in eastern North American forests

April 6 2009

With climate change looming, the hunt for places that can soak up carbon dioxide from the atmosphere is on.

Obvious "sinks" for the greenhouse gas include the oceans and the enormous trees of tropical rainforests. But temperate forests also play a role, and new research now suggests they can store more carbon than previously thought.

In a study that drew on both historical and present-day datasets, Jeanine Rhemtulla of McGill University and David Mladenoff and Murray Clayton of University of Wisconsin-Madison quantified and compared the above-ground carbon held in the forest trees of Wisconsin just prior to European settlement and widespread logging, and the total carbon they contain today.

Writing in the current issue of the Proceedings of the National Academy of Sciences, the researchers report that despite decades of forest recovery, Wisconsin's woodlands still only hold about two-thirds the carbon of pre-settlement times — suggesting substantial room for them to accumulate more.

"There's probably more potential (to store carbon) than people were considering," says Mladenoff. "There's still a big difference between what was once there and what's there now."

He adds that the true storage potential is probably at least two-fold

higher than what he and Rhemtulla calculated, since they factored in only the live, above-ground biomass of tree trunks and crowns, and not the carbon stored in roots and soil.

The results have implications not only for Wisconsin, but also for regions across eastern North America where forests were leveled historically to make room for agriculture, and then grew up again as settlers abandoned their farms and headed west. In Wisconsin, for example, forest biomass and carbon have been steadily recovering since the peak of agricultural clearing in the 1930s, while those in the northeastern U.S. have been rebounding for about 125 years.

Yet, it's precisely because many temperate forests have been recovering for so long that people tend to assume their potential as carbon sinks is "maxed out," says Mladenoff.

"Our results suggest we need to rethink this," he says. "Rather than there being an intrinsic limit on how much carbon a forest can store, how we use the forest — how much we log, how we manage — may be more important."

The findings come amid sweeping discussions of international carbon treaties and accounting systems that are designed to reduce CO2 emissions and combat climate change. In the future, for instance, countries might earn credits for maintaining carbon-rich old-growth forests, or replanting trees on lands logged off previously for agriculture.

Areas that once supported large amounts of forest biomass might also be good sites for growing plantations of hybrid poplar and other biofuels crops, says Mladenoff. But, he cautions, any move toward planting more land in trees must be weighed against competing social and economic factors, such as the need for farmland.

"The landscape is full," says Mladenoff. "So if we're going to add something like forests, we're going to need to take something out."

That certainly seems to be true in Wisconsin. Based on historic carbon levels, the researchers' analysis found that much of the best land for growing trees is the north-central region and along northern Lake Michigan. If those lands could be reforested to pre-settlement levels, the scientists estimate they could add 150 teragrams of carbon (150 million metric tons) to the state's current total of approximately 275 teragrams.

The problem, however, is that most of those lands are still being farmed, setting up an interesting dilemma for policy makers: how to weigh the current economic benefit of agriculture against the future environmental benefit of carbon storage.

"Because we often forget the invisible services, like climate regulation, that ecosystems provide to us for free, we don't usually factor them into our decision making," says Rhemtulla. "But this will need to change if we're going to find ways to meet our immediate needs without compromising critical services over the long term."

Source: University of Wisconsin-Madison (news : web)