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Can Timber Harvest Benefit Global Climates?

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Large portions of our world population would want the answer to this question to be either yes or no. The answer is that it depends. The most prominent global climatic concern is the *greenhouse effect*, where increasing carbon dioxide (CO_2) in the atmosphere leads to heavier air that traps more of the Earth's heat. The most popular solution is to plant more trees and halt or greatly reduce the harvest of established trees. This solution is based on the common belief that trees absorb CO_2 and produce oxygen (true) by breathing (untrue!).

Not all scientists agree on the existence or extent of a greenhouse effect, however we need to better understand tree physiology and how trees produce oxygen and reduce atmospheric CO_2. This can help individuals and organizations make better decisions about planting or harvesting trees with regard for harm or benefit to local and global climates.

Trees, as do all living things on earth, breathe in oxygen and breathe out CO_2. This process, called respiration, provides the energy that drives all other life processes. Photosynthesis is the process found only in green plants, including trees, that uses water, CO_2, and the sun's energy to produce food. Oxygen is a by-product of photosynthesis, not respiration. This is important to the issue because most people do not understand that it is the food producing processes of trees, not respiration, that can produce oxygen and reduce CO_2. Understanding this leads to awareness that how fast a tree is growing, not just its presence, is the most important factor in a tree's potential to modify the greenhouse effect. It is also important to understand that evergreen trees carry a lot of old leaves or needles that can use more oxygen in respiration than they release in photosynthesis, and release more CO_2 than they absorb.

On a recent field tour with a group of about 70 schoolteachers, woodland owners, and several other foresters, we visited a 4-year-old plantation of sapling trees on a 28 acre clearcut. Most of the audience, when questioned, believed that trees breathed in CO_2 and out oxygen. After clarifying their understanding about respiration and photosynthesis, we took a fresh look at the total harvest (clearcut) of the original forest and its replacement with vigorously growing planted trees. The original forest was primarily composed of fir trees that had been repeatedly defoliated by spruce budworm larvae feeding on the upper needles of the mature trees. This left a forest composed mainly of old, slow growing trees that probably used more oxygen than they produced, and absorbed little CO_2 with their inefficient photosynthetic rates. The old evergreen needles at the bottom of the tree crowns were producing just enough food to keep the trees alive but not enough oxygen to balance or exceed respiration; these trees were replaced by clearcutting and planting after careful consideration of wildlife, water quality, visual, economic, and other impacts. The newly planted trees have doubled their size each year after planting and are producing excess oxygen and absorbing excess CO_2.

There are other complicating factors that we are just beginning to measure for their effect on net atmospheric impacts. For example, the harvest of the decadent forest in the above example should increase decomposition rates of forest litter and any tree material left on the site, releasing carbon stored in

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photosynthesis. The portion of the tree that is used in building materials and other products keeps the stored carbon out of the atmosphere, but if any of this material is burned or decayed, then carbon will be released.

Understanding tree life processes can help us make better decisions for the environment when it comes to harvest or planting decisions. Scientists have developed a good basic knowledge of these processes but have only recently been able to develop more specific information on tree and forest impacts on climates. This chart below was developed by the USDA Forest Service to provide incentive and information about planting trees to counteract individual contributions to increases in atmospheric CO_2.

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Your Age	Seedlings	Nursery Trees	10 Year Old Trees
	or	or	
0	45	40	30
10	60	50	35
20	80	65	40
30	120	85	50
40	210	135	70
50	550	255	95

This chart helps you find the number of seedling OR young trees you need to steward for the rest of your life to account for your 2.3 tons/year of carbon.