

THE REAL SCORE ON CO₂ EMISSIONS AND FRAMING MATERIALS

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In reading timber industry literature about their CO₂ emissions, one encounters arguments that are both logical and intuitive: Wood products sequester carbon, sometimes for decades. Producing steel or concrete consumes more energy and results in more emissions, worsening global warming. These are clean arguments on the surface, and are echoed by various studies from NGO's:

“Reversing current forest trends - where building materials like steel and aluminum have been replacing wood- would deliver a net CO₂ benefit to the forests, and outside of it”: Pacific Forest Trust, *Forest Carbon in the United States*, 2007.

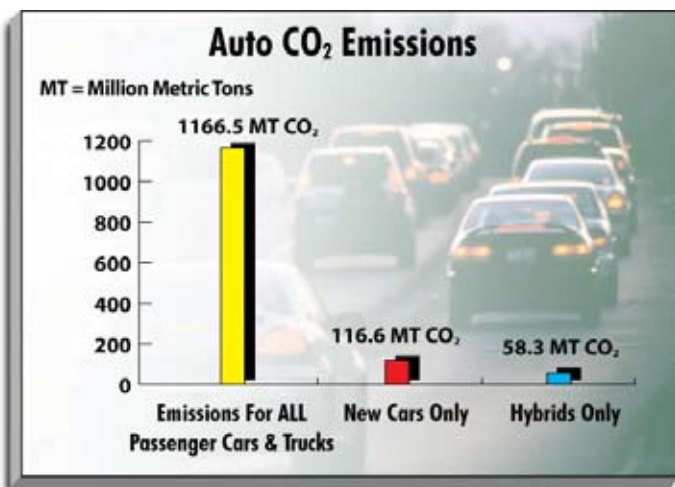


Steel Framing Alliance

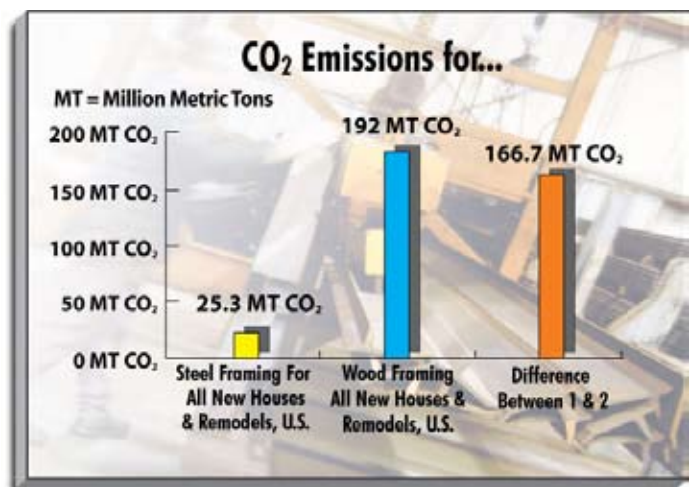
Steel has been replacing wood in house framing, and will result in a net CO₂ emissions reduction.

“Shorter rotations contributed to fewer carbon emissions, since the impact of reducing the use of fossil fuel-intensive, non-wood products more than offsets the effect of reduced carbon stored in the forest” CORRIM report, (Consortium for Research on Renewable Industrial Materials), from *Wood and Fiber Science*, 2006.

Other research organizations and even the Union of Concerned Scientists jumped on the bandwagon, and parroted the Pacific Forest Trust claim on their websites.



Source: EPA Emissions and Sinks, 2007



Source: Energy Information Administration, 2005

The problem with these arguments is not only that they are false, but that the data support a quite opposite conclusion: Substitution of steel for lumber in a house framing application would result in a major reduction in America's CO₂ emissions. The data show that harvesting wood for housing produces over *seven times* the greenhouse gas emissions of steel. Even better, switching to steel in all new residential construction would have 2.9 times the positive impact on the US CO₂ emissions budget by requiring every new car and light truck sold to be a hybrid or other technology that doubled gas mileage.

Figures for the American steel industry's CO₂ emissions are not difficult to find: according to the Energy Information Administration, using data from EPA, the steel industry's emissions are 126 Mt (million metric tons) of CO₂ annually. This includes consumption of blast furnace coal and all other energy sources, such as natural gas and electricity from the grid. By calculating steel required for framing an average house size and starts¹, the amount of steel needed to substitute for all wood used in house and remodel framing is 23.47 million tons, causing 25.3 Mt of CO₂ emissions.

Certainly, this is no small amount of greenhouse gas. A million tons of CO₂ emissions equals the burden of 207,000 cars. The steel industry overall contributes 2.1% of annual US CO₂ emissions, of which new house and remodel steel framing substitution would consume about a fifth, for .4% of the US total.

By contrast, the timber industry's practices produce externalities in the form of harvesting caused site emissions. When trees are cut down, soil, slash, debris, and other nonmerchantable biomass is disturbed and then released into the atmosphere in a short time period as carbon dioxide. Road building in the forest consumes major amounts of fossil fuels in construction equipment and transportation of the product, and disturbs soils and surrounding biota. Emissions from these sources are over three times larger than what ends up in wood products emerging from the mill, according to carbon scientists.

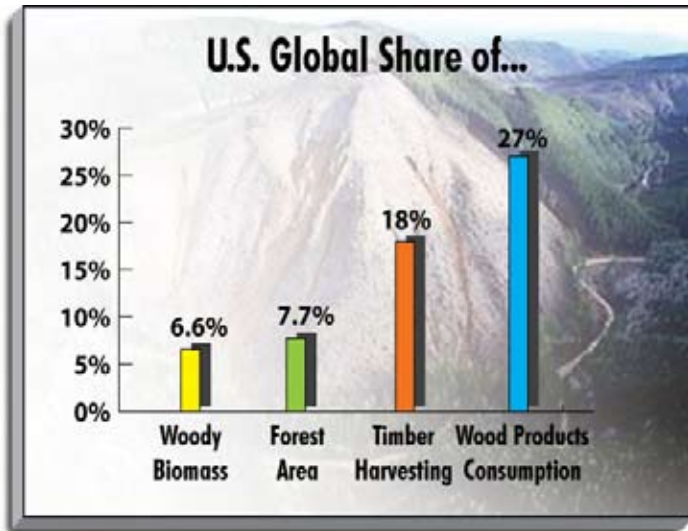
In order to understand the full scale of US timber industry CO₂ emissions, it is useful to first look at the global picture. In spite of our having only 2% of the world's remaining frontier forests², and 6.6% of the planet's woody biomass, the US produces 18% of the world's industrial roundwood, or raw timber harvest³. Even more startling, we consume 27% of the planet's wood products, more than the total for the four billion people who live in Asia⁴.

Deforestation accounts for about 20% of global CO₂ emissions, according to most scientists and the latest IPCC reports. The Stern Report, commissioned by the British Government, considers the number to be much higher, and recommends halting deforestation as the most cost effective and immediate way to mitigate climate change. The United States is the seventh leading deforester in the world,

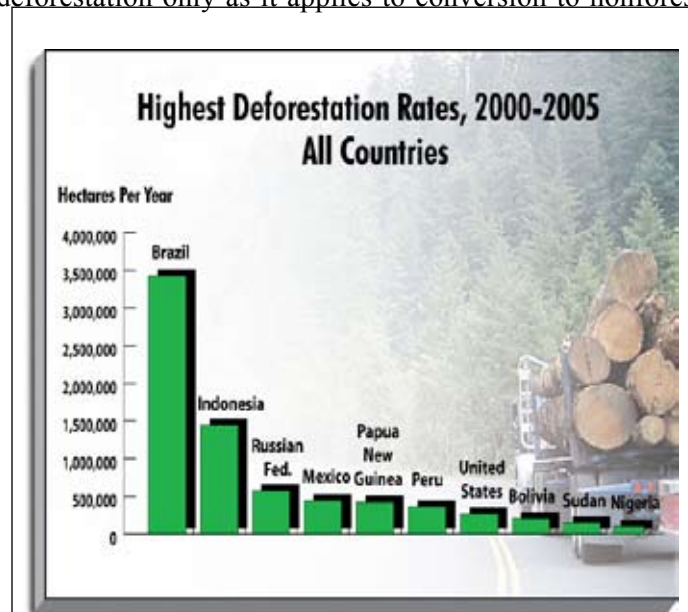
just behind Papua New Guinea and Peru, according to the U.N. Food and Agriculture Organization, at an average deforestation rate of 530,000 acres or 831 square miles per year. Pacific Forest Trust puts the number higher, at 1.275 million acres of forest lost annually. The US contribution to this unsettling total is a combination of urbanization of forest land and conversion of old growth forest to tree plantations. Our own Department of Agriculture counts deforestation only as it applies to conversion to nonforest uses, and also has no statistic for clearcuts that have failed

to regenerate- a common phenomenon in areas such as Southern Oregon and Montana.

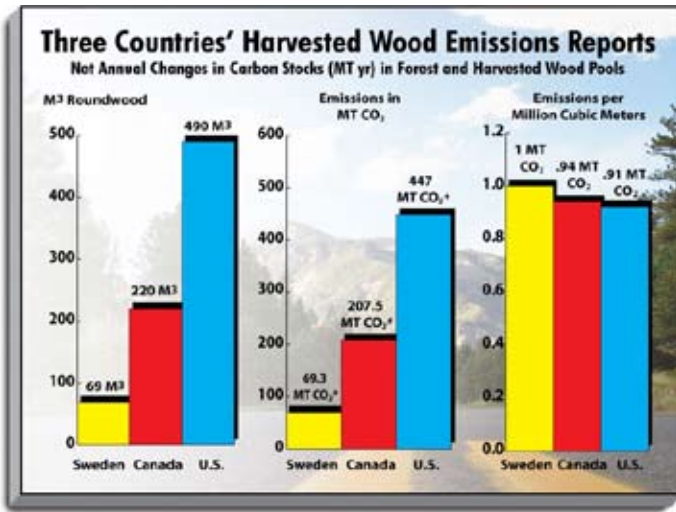
The impact of industrial logging operations is even more important to our carbon budget than the loss of forest acreage. Other countries, or at least the Kyoto signatories, acknowledge this, and duly report this burden in country submittals to IPCC. Canada's and Sweden's geography and softwood species character are similar to much of the US. In 2005, Canada's timber industry emissions burden, using the Production approach and accounting for harvesting slash and debris, was 207.5 Million tons of CO₂ annually. The Production approach is generally the smallest of the four recommended methods in terms of emissions values. Canada's Boreal Forest, the largest terrestrial carbon sink on the planet, is being clearcut for the American lumber market. Sweden reported 69.3 Mt CO₂ for their Harvest Wood Products Emissions at the Lillhammer 2004 IPCC conference, also using the Pro-



Source: U.N. Food and Agriculture Organization, 2006 (FAO)



Source: FAO



Sources: From Lillenhammer Conference Submittal, 2004
 From IPCC Country Submittal with text, 2005
 From EPA Emissions and Sinks, 2007
 Turner, et. al., 1995

duction approach.

Since there is no official figure for US timber harvesting caused emissions, three sources were studied: *EPA Emissions and Sinks 2007*, data from Annex 3; Turner et al., “A Carbon Budget for Forests of the Conterminous United States”, *Ecological Applications*, May 1995, and *Carbon Trends of the Productive Temperate Forests of the Conterminous United States*, by Linda Heath and Richard Birdsey, two eminent US Forest Service carbon scientists. The Turner study was coauthored by Dr. Mark Harmon, considered by many to be the nation’s leading carbon forestry expert, and the Heath and Birdsey paper was published under the Global Change Research Program in 1993. According to experts in the field, the science behind these calculations has not changed substantially since that time. Estimates for annual logging caused CO₂ emissions that derive from these three sources are as follows:

EPA Emissions and Sinks, from Annex 3
 Turner, et. al.
 Heath and Birdsey (with updated data)

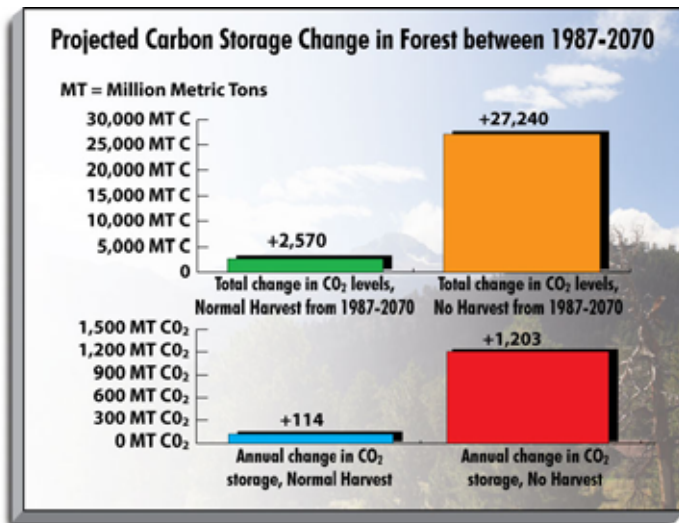
433 million Metric tons CO₂ emissions
 461 Mt CO₂
 719 Mt CO₂

The Heath and Birdsey study projected two scenarios: normal harvesting in the US forest and not harvesting any trees at all. While this is an excellent way to determine logging caused emissions, the uncertainties associated with long time lines and unknown future forest sequestration rates led to the decision to show the results as a matter of interest only. For purposes of arriving at an accurate and conservative figure, we used a midpoint of the first two sources listed above, for a total of 447 Mt CO₂. This is a very conservative number, partly because emissions from imported wood and sawmill and shipping fossil fuel use are not included due to sketchy data.

The percentage calculation for emissions from harvested wood products used in home construction, remodeling, and light commercial buildings was derived from The 2005 RPA (Resources Planning Act) Timber Assessment Update. This is a US Government publication, which lists timber inventory, future projections, and market destinations of wood products.

According to RPA⁵, 43% of US annual timber harvest ends up as wood construction elements. Multiplying 447 Mt CO₂ by .43, we arrive at 192 Mt CO₂ per year, or 7.6 times the steel framing figure of 25.3 Mt CO₂. This figure does not include imported lumber from Canada, which accounts for roughly 30% of the total used in housing. Much of this material comes from old growth forests in the Boreal region, resulting in American demand decimating another key global carbon sink.

The US Government EPA Emissions and Sinks Land Use and Forestry section does not report logging caused emissions, except by inference from the tables in the 179 page Annex 3. Both the US IPCC submittal and the Energy Information Administration tables report only net US forest sequestration. The US methodology does not include items such as woody debris, roots and branches, and



Heath and Birdsey, “Carbon Trends of Productive Temperate Forests of the Conterminous United States”, 1993.

mill waste, except as noted in separate column headings. Only the boles (trunks) of trees are calculated for the basic US submittals. This is not a rigorous way to report emissions, even though, as a non signatory to Kyoto, we are not obligated to do so. When a forested site is clearcut, only about a third of the carbon on site goes to the pulp or sawmill. Much of the remaining carbon is subject to losses from decomposition following harvest to the atmosphere as coarse and fine debris, branches and roots, and disturbed soil. Of the one third of the carbon that is trucked to the mill as logs,

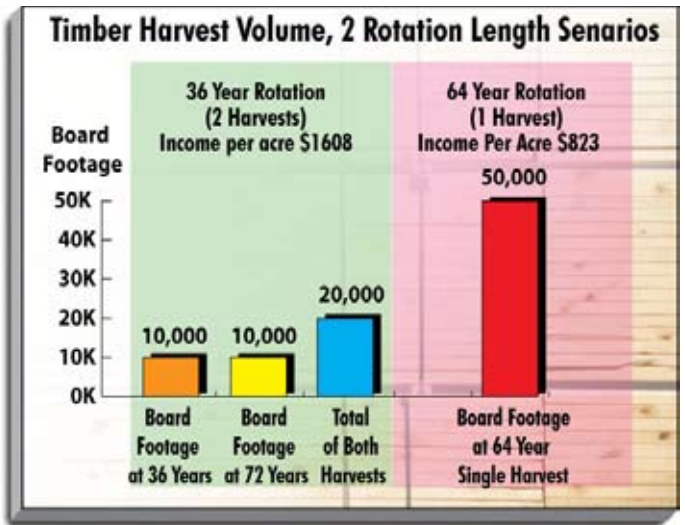
close to half of that disappears in the form of mill waste and sawdust. This leaves about 20% of the site's carbon as potential carbon reservoirs in wood products. There are site related variables to this calculation, but the basic science is not in dispute, even if some consider the carbon ending up in wood products to be closer to 25% of the total.

The 20% of site carbon "locked up" as wood products has been the focus of timber industry public relations efforts. The major emissions that scientists know come from logging, and its large contribution to climate change, have galvanized many countries' timber interests to spin the evidence. The original Kyoto protocol allowed no sequestration credit for harvested wood products, since they are merely replacing wood products that have decayed and released their CO₂ into the atmosphere. This rule has been modified due to industry pressure. Now, the only current IPCC requirement in order to claim harvested wood products carbon credits is that the reporting country has to prove increasing forest land and product pool sequestration over time, with 1990 as a baseline. Note in the chart below that EPA went from a decrease to an increase in carbon sequestration from 2005 to 2007, justified by rather puzzling (recalculations discussion).

There are now several options available to report land use emissions under new IPCC rules, which have been discussed in 12 international conferences. It doesn't take 12 conferences to decide how to calculate emissions from tailpipes and power plants. Global timber interests appear to be seeking to generate and interpret emissions data in order to reduce their industry sector scores, which have been in a declining trend since this reporting began in the 1990's. Since some countries do not have the ability to record harvesting emissions from slash, debris, and soil, country submittals are now allowed to report only the wood products that leave the harvesting site. The United States leaped into this loophole, even though our raw data and equations for site emissions are reasonably comprehensive.

Many scientists who have studied the matter of course question these new ways to count biomass, since emissions mostly occur from litter and slash at the harvesting site regardless of the country or site characteristics. At the recent Bali IPCC conference, problems related to logging-caused deforestation were at the top of the agenda in proposed climate change mitigation solutions.

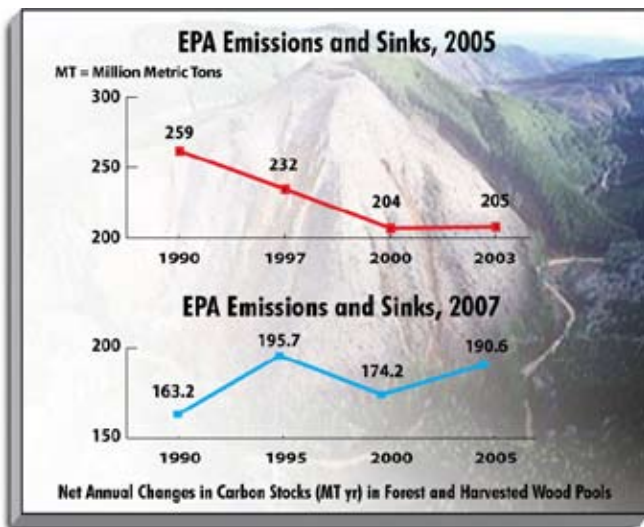
There is another group of well intentioned conservationists who want to change American timber industry practices to leave more trees on a harvest site and, especially, to lengthen harvest rotations. While many biologists, especially in Europe, do not approve of clearcutting, if you are going to do it long rotations are preferable: A douglas fir stand in the West harvested at 36 years yields 10,000 board feet. At 64 years, or close to productive maturity, the same trees grow to produce 50,000 board feet, with better quality lumber and far more carbon sequestered. Related benefits include less soil disturbance and erosion and some return to biodiversity. This is a classic example of a market failure, where less material is produced due to the unacceptably long time required for forests to achieve large trunk girth and surrounding biological diversity and forest health.



Source: Wood and Fiber Science, quoted in Raphael, More Tree Talk

Long rotations are not likely to happen, and the trend is for them to become shorter. Due to the accelerating cost of sunk capital, revenues from two harvests of 36 years each are approximately double compared to the single harvest at 64 years, in spite of the longer rotation's much larger (and higher quality) product yield. Timber analysts assume this in their projections. Much timberland is now owned by Real Estate Investment Trusts (REIT's) and Timber Management Investment Trusts (TIMO's). These are serious businessmen, and they are not going to give money away by waiting for the trees to grow to maturity. Various well

Source: EPA Emissions and Sinks, 2005, 2007



Source: EPA Emissions and Sinks, 2005, 2007

meaning NGO's continue to attend timber industry gatherings to argue for long rotations, but the market will probably not allow for this change. It occurs to some extent in Great Britain, which has a small timber industry and wants to comply with Kyoto goals, and Sweden, which subsidizes much longer rotations. Here in the US, however, builders and consumers have come to demand cheap wood. While framing materials are only about 7% of a house's hard construction budget, it is the biggest single item for a builder, and lumber prices have historically been volatile. Many building interests have long fought for government policy which encourages low lumber prices.

They have succeeded over the years, but the result is a trap: wood framed houses do not last beyond two or three generations without requiring extensive maintenance. In many cases, 60 year old houses are torn down, resulting in sending all of the other homebuilding elements to a landfill as well. Cheap wood, however, has had the effect of perpetuating lumber dominance in the home construction industry, a habit shared by only a handful of other countries. Having built housing on other continents, I can attest to the fact that people from overseas are puzzled about our habit of building houses that are disposable consumer products. A steel stud, by contrast, has been shown by laboratory tests to last for over 600 years in a wall framing application, and after that time it can be fully recycled. Sadly, builders are not much concerned about wood framed houses that begin to deteriorate in a few decades, because their financial responsibility has long since ceased. Only the public can effect a change in the quality of house framing.

With this change in public demand for wood products, financial incentives could be put in place that would reward private landowners for allowing the timber on their property to grow for a century or beyond. More carbon would be stored, and secondary benefits would include restoration of wildlife habitat and fish migrations. The current pattern of attempting to claim carbon credits for sterile tree plantations is beginning to fall out of favor.

"It is the double whammy of climate change combined with fragmented, degraded natural habitats- not climate change alone- that is the real threat to many populations, species, and ecosystems, including human populations marginalized and displaced by these combined forces": Michael Novacek, provost of the American Museum of Natural History.

Less than 10% of our native forests remain in a condition close to their presettlement state, and the number according to many is closer to 5%. This statistic shows historical deforestation that far exceeds that in the Amazon or the Russian Taiga. I have lived in California and the Northwest almost all of my life, and, like many others, have long been disturbed by logging devastation in our coastal forests. These lands, when unlogged, store more carbon per acre than any terrestrial ecosystem in the world- over 1000 tons per acre near the coast, compared to less than 200 tons per acre in a tropical rainforest. This translates into vast biological wealth, with food chains including all manner of mammals, raptors, and quite beautiful ferns and flowers. Western Oregon, for example, with little land set aside for park or wilderness, is an ecological sacrifice zone, similar to West Virginia and its blasted mountaintops.

There were once great salmon and steelhead migrations in our Northwest coastal rivers- I fished them as a child, and took people on guided river trips on them in the 1970's. These fish were the main protein source and keystone species for the region, feeding creatures such as eagles, otters, and bears, as well as local fishermen. The fishes' carcasses, and the feces of their predators, nourished the forest soil, similar to the great herds of the African savannah.

When a forest is clearcut, siltation increases by an average of 1,400% in Class I spawning streams, according to an Oregon Board of Forestry study. This can destroy salmon runs, often permanently. Nobody knows how long the tree farms that have mostly replaced the great forests will last over time. Turning this steep and rugged land into short rotation industrial forests, with herbicides, little biodiversity, and various other insults to the land, is unwise in the long run. Several academic studies have indicated that a mature forest is worth far more economically than one that is repeatedly clearcut, even after allowing for income from lumber buyers. Reasons include multiple and long term income streams from recreation, migratory fish, harvest of products such as truffles and incense cedars, and clean water supply.

Niche financial interests, however, especially timber and homebuilding, have historically prevailed, regardless of the political party in power. Recently, Mark Rey, the former timber industry lobbyist who is now the Forestry Undersecretary in the Department of Agriculture, has been spearheading an effort to log the scant remaining old growth in Western Oregon Bureau of Land Management holdings. A majority of Oregonians, who would supposedly benefit from promised



Courtesy Photo
Management Activities, Terwer Creek, Klamath River drainage, Northern California Coast Range.

timber jobs and money for local governments, are fiercely opposed, according to surveys. The immediate impact on our carbon emissions budget would be vast: a study by Mark Harmon and Jerry Franklin in 1990 calculated the carbon burden of liquidating our primary Northwest forest up to that point at 1.8 billion tons. A much better national policy would be to allow these denuded lands to grow back to something resembling their original stature and biological richness.

This would be especially wise due to another problem related to climate change: According to many biologists, diverse, mature forests resist disturbances exacerbated by climate change far better than single species tree plantations. This is true for all events increasingly tied to hotter temperatures, such as insect infestations, drought, extreme wind, and landslides. In



Finally, Americans need to respect our natural heritage. I have often encountered Europeans in our remnant coastal redwood and fir forests, who speak of them as if they were our great cathedrals.

the long term, we are much better off managing forests to encourage biodiversity, and to allow for nature to make adjustments. Tree farms do not even sequester carbon faster: I asked Jerry Franklin of the University of Washington, one of our most eminent forest ecologists, what would be the difference in the amount of carbon sequestered fifty years later if we planted and managed trees on clearcut land versus allowing the land to regenerate naturally. Franklin told me that the amount of sequestered carbon would be about the same. Industry claims about their personnel “growing” trees and locking up carbon really just refer to concentrating photosynthesis on the trunks of selected species that can be sold for lumber.

There is a spiritual price to be paid for destroying wilderness. I have often encountered Europeans in our remnant coastal redwood and fir forests, who speak of them as if they were our great cathedrals. A woman visitor once said she came here because “England is a clearcut”. Americans who view the trees only from the main roads should either walk deep into the forests or perform a Google Earth tour to view the destruction. We can no longer allow industrial forestry to continue its assault on what is left of possibly the most spectacular forest on the planet. The most important reward for the effort to restore our forests would be a major and immediate step toward slowing the march of global warming, which is increasingly believed to threaten our survival as a species. Economic dislocation would be minimal: after the Dwyer Spotted Owl decision of 1991, timber economists predicted that the Northwest would be-

come “another Appalachia”. Instead, the region entered a period of sustained growth unique in its history, as the area’s natural beauty attracted businesses. We would build fewer houses in the long term, as our houses would be built to last, but the effect would be to make us a more truly affluent nation.

Notes:

1. From National Association of Homebuilders website, data to 2007: Average size of US home, 2469 square feet; 10 year average of new single family homes built, 1,386 million. From US steel industry: Pounds of steel per square foot to frame a house, 6; total steel for new house framing, 10.27 million tons (10.5% of annual US steel production); 10.5% of 126 million tons of CO₂ = 13.2 million tons CO₂; steel required for remodeling/additions and light commercial, 12 million tons (author’s estimate per RPA tables).

2. World Resources Institute, 2005

3. UN Food and Agriculture Organization, 2006
4. Forest Resources of the United States, US Department of Agriculture, 2002
5. 2005 RPA (Resources Planning Assessment) Timber Assessment Update, US Department of Agriculture.

