Combining Carbon Pools

1. Where does the carbon come from when trees grow?

   When trees grow, they use carbon from atmospheric carbon dioxide and convert that carbon into biomass (i.e., wood).

2. When the forest is cut (years 2045, 2090, and 2135), which carbon pools decrease immediately? Which carbon pools increase immediately? For each carbon pool, explain why it increases or decreases.

   Forest pool: Decreases since trees are being cut from the forest
   Dead wood: Increases due to the amount of dead wood produced as a waste product during harvesting
   Short-lived wood products: Increases as some of the harvested wood is used to make these products
   Long-lived wood products: Increases as some of the harvested wood is used to make these long-lived products
   Carbon saved: Increases as the wood products are used instead of other, carbon-intensive products.

3. What happens immediately to the total carbon (represented by the black line that follows the top edge of the colored area on the graph) during the years that trees are harvested? Explain why in terms of your answer to Question 2.

   The total amount of carbon sequestered increases immediately. This is because the increases in the pools for long-lived wood products and carbon saved more than balance the decreases from harvesting trees and from using fossil-fuel burning equipment (Gonzalez-Benecke et al., 2011). Dead wood and short-lived wood products also increase (though not nearly as much), contributing to the total increase during harvest years.

4. What happens to the total carbon sequestered during the decade after each harvest year (2045–2055, 2090–2100, and 2135–2145)? Explain this behavior in terms of the carbon pools.

   In the decade following harvest years, the total amount of sequestered carbon decreases slightly. This is because the dead wood and short-lived wood products both decompose relatively quickly, so carbon is lost from those pools.

5. What happens to the total carbon sequestered at year 2125? Which carbon pool is responsible for this behavior? Explain why this carbon pool changes during this year.

   At 2125 the total amount of carbon sequestered drops from about 560 metric tons per hectare (MT/ha) down to about 500 MT/ha. This is because the assumed lifespan of the long-lived wood products is 80 years. Therefore, the long-lived wood products, produced from the wood of the 2045 harvest, are burned as waste or decomposed by 2125.

6. Describe the carbon-saved pool. Why is this the biggest component on the graph? If it is so much bigger than the forest pool, can we obtain these benefits without the forest carbon pool?

   The carbon-saved pool refers to carbon emissions from fossil fuels and cement production that have been avoided by using wood products instead of carbon-intensive products, such as concrete. The size of this pool indicates the large amount of fossil fuels that go into producing carbon-intensive products. To answer the final part of this question, consider other ways to avoid manufacturing carbon-intensive products.

7. Which carbon pools tend to grow over time and which ones are cyclical, rising and falling over time? What insights about carbon sequestration does this provide?

   This can best be seen in the graphs of individual pools. Notice that the carbon saved pool continues to accumulate, ratcheting up in three steps over the time period. Conversely, live trees, dead wood, and short-lived wood products cycle through periods of increase and decrease. This suggests that while harvesting wood creates a short-term loss of carbon storage, the use of sustainably forested wood can help us avoid long-term emissions from fossil fuels.