Common Misconceptions about Forest Carbon

Misconception:

1. "*Young stands take up carbon quickly, therefore we should convert old-growth and harvest at when stands reach their maximum Mean Annual Increment (MAI)*."

   Actually:

   - Harvesting an old stand with a low or zero yield increment and replacing it with a young vigorous stand seems to make sense for mitigating climate change since the growth of the tree is a sign of carbon uptake. While that statement is true from a "flux" or "annual uptake" point of view, it's less certain when you think about carbon stocks. What is being done with the harvested carbon? Is it being burned in slash piles, turned into paper or solid-wood furniture? The amount of carbon stored in a 300 year old stand can be huge. To get back to the same carbon density per hectare could take 250 years or more.

   - From a carbon storage point of view, longer rotations result in more carbon stored per hectare. The carbon benefit of longer rotations is not due to the rate of uptake (which slows after 80-100 years). The benefit is due to the storage in the biomass and relative balance of the annual turnover (litterfall and mortality) with the decomposition of dead wood and soil carbon. If a stand that has historically been disturbed every 350 years starts to be part of a thirty year rotation plan, there will be a lot of carbon dioxide ($CO_{2)}$ released from the soil. Less carbon will be transferred from the living biomass to the dead wood and soil to maintain the carbon stocks on the site. On the other hand, if a site has already been harvested and is part of a short-rotation system, it might be better to maintain the short-rotation and have the carbon stored as forest products, rather than shift an alternate stand from long rotation to short rotation.

2. **Misconception**: "*It's best to maximize carbon storage in the ecosystem, therefore we should stop harvesting.*"
   - **Actually:** Maximizing carbon storage in the ecosystem would make sense only if society stopped building new homes, acquiring new furniture and consuming in general. If the flow of forest products stops, society will turn to other products with higher greenhouse gas footprints, e.g. plastics, metal, or concrete. In addition, if harvesting stopped and we continued to suppress natural disturbances, there is increased potential for larger catastrophic disturbances in the future.

3. **Misconception**: "*Bioenergy is always good/clean/Carbon-neutral.*"
   - **Actually**: This misconception stems, in part from an artefact or distortion caused by the Greenhouse Gas (GHG) accounting rules. All harvested carbon is currently reported as an immediate emission under the forest sector. Therefore, using fibre for energy does not appear as a carbon-emission in a GHG inventory.
   - Wood has a lower energy density than fossil fuels so burning it to produce heat or electricity produces more carbon dioxide per Kilowatt (kWh) or British Thermal Unit (BTU).
   - Substituting bio-energy for hydro power results in much more CO2 per kWh.
   - Factors favouring wood as a source of bioenergy include: wood is renewable over long timescales (>75 years in most cases); and wood bioenergy uses carbon that's already within the biosphere. Converting dead wood to biofuels leaves the remaining live trees to soak up carbon.

And replacing fossil fuel with biofuel from dead wood reduces the amount of new carbon in the atmosphere.

4. **Misconception**: "*Short rotation managed stands are better at carbon storage than unmanaged stands.*"
    - **Actually**: This misconception hinges in part on the assumptions that carbon stored in deadwood and soils are inconsequential, and that decomposition is the same in managed and unmanaged stands. These assumptions are not true. If the whole ecosystem is considered, there is more storage in the unmanaged stands than in managed stands.
    - This misconception also relies on estimates of carbon storage in wood products, landfills & avoided emissions, which have an uncertainty of more than 40%. Better data is needed for BC to properly compare unmanaged with short-rotation stands.
    - The fibre produced from short rotation stands may have a shorter lifecycle than that produced by long rotation stands (for example, cottonwood, or small diameter wood producing low quality/value products). Wood products from large diameter, high value species have been used to build structures that have life expectancies in the hundreds of years. Old timbers and furniture built with high quality wood retain their value and last longer. This wood is easily re-used (e.g. timbers in old warehouses).

5. **Misconception**: "*All harvested carbon is stored for a long time*."
    - **Actually:** Accounting for harvested carbon is complicated and we lack proper decision-support tools. Therefore, it's easy to over-simplify, assuming either all harvested carbon is stored permanently or all carbon is emitted to the atmosphere in the same year it's harvested. The real answer lies somewhere in between. For BC wood used domestically, approximately 25-40% of carbon harvested in BC is stored for a long period of time in products.

6. **Misconception**: "*Converting* ***riparian broadleaves to conifers*** *is a good idea for carbon storage*."
    - **Actually**: Some are considering cutting short-lived alder in riparian areas and replacing them with longer-lived and larger conifer species. Over the long term (>75 years), that approach may result in an increase in net carbon storage on the site, but there are many risks. These areas may be populated by alder or cottonwood because of a fluctuating water table or because they are prone to flooding, whereas many conifers require good drainage. Harvesting itself causes a net loss of carbon from the ecosystem through reduced net growth and increased decomposition at the site. In addition, carbon in the soil could be lost through stream-bank erosion. Other non-timber forest values could be jeopardized by harvest activity in riparian areas: e.g. water quality, fish habitat, biodiversity, or ecosystem resilience.

7. **Misconception**: "*Converting* ***conifers to broadleavess*** *is a good idea for carbon storage*."
    - **Actually:** Many British Columbia conifers have a higher wood density than BC hardwoods and therefore more carbon. Coastal Douglas-fir for example is equal in wood density to birch and much higher than aspen and cottonwood. Douglas-fir is also very fast growing for a longer period of time and lives longer than most native and exotic hardwood species.
    - This misconception probably stems from hardwoods in eastern North America which are high density and long-lived species (e.g. sugar maple, oak). Depending on soil, hydrology, disease and other characteristics, some areas are well-suited to conifer forests, some to broadleaves, and some to mixed forest.

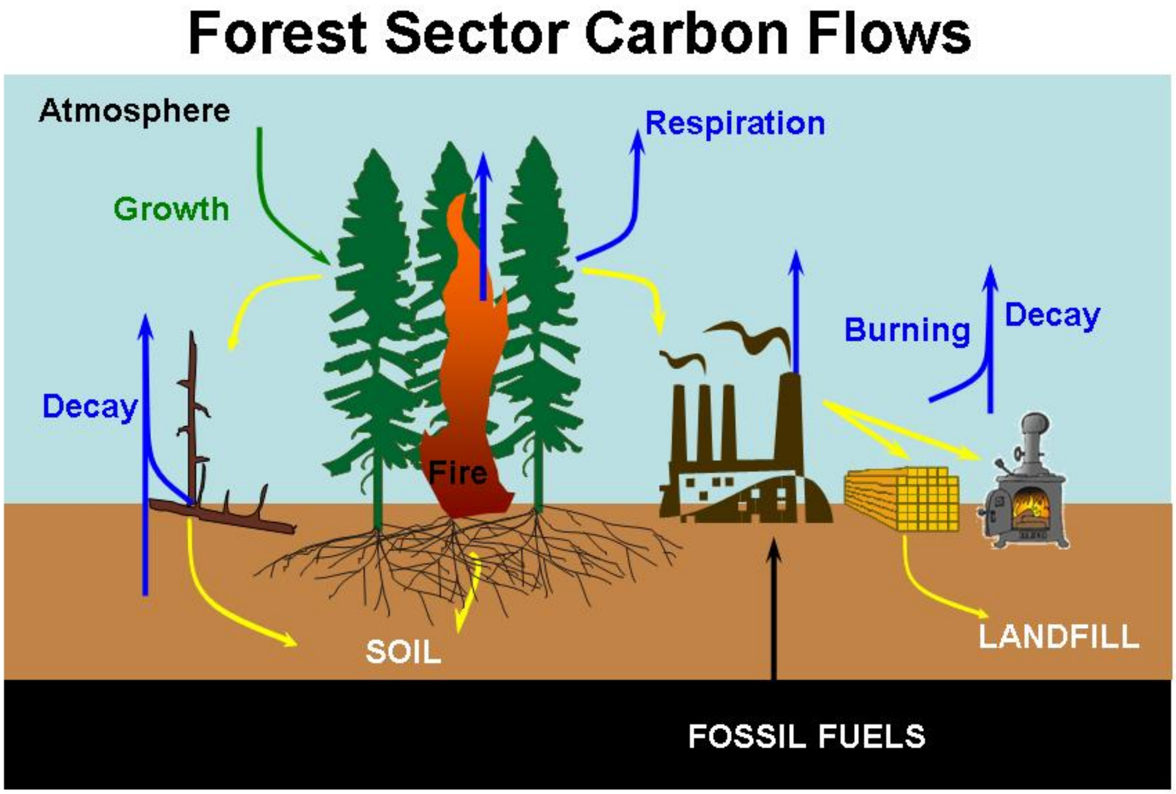

Image: C. Dymond and M. Apps

In the diagram above, Carbon is taken up from the atmosphere as trees grow (green arrow). From there, carbon may be released back to the atmosphere (blue arrows) or transferred within the ecosystem or to the forest products industry (yellow arrows). Plant respiration, forest fires, and natural decay cause releases of carbon to the atmosphere. Harvesting triggers the release of carbon from forests due to burning for bioenergy and decay. Long-term storage of carbon occurs in the trees themselves, in forest soils, in long-lived forest products, and in landfills.