

Science Background: Humans, the Global Carbon Cycle, and Terrestrial Sinks

Units of Measure for Amounts of Carbon

- Units of Measure
 - Mt (metric tons) = T (tonnes)
 - “Metric ton” used commonly in U.S.
 - 1 Mt = 1,000,000 grams = 1,000 kilograms
 - MMT (million metric tonnes) = Megatonne
 - Gt (gigatonne or metric gigaton) = Pg (petagram)
- Converting carbon to CO₂
 - CO₂ = C * 3.67**
 - Carbon - element
 - CO₂ - compound
- Other common units of measurement
 - Smaller scale (i.e. corporate, small country)
 - MMT = million metric tons
 - Large scale (i.e. global)
 - Gt = gigatons
 - Pg = petagrams

Unit Conversion to Mt

Unit	Metric Tons Equivalent
Mt or T	1
MMT or Megatonne	10 ⁶
Gt or Pg	10 ⁹

Global Carbon Cycle

- Pools show carbon stored in parenthesis
- Flows indicated by arrows
- Natural pools and flows shown in green, blue and brown
 - Balanced over time
- Anthropogenic activities shown in red
 - No counterbalancing process = net atmospheric increase of CO₂

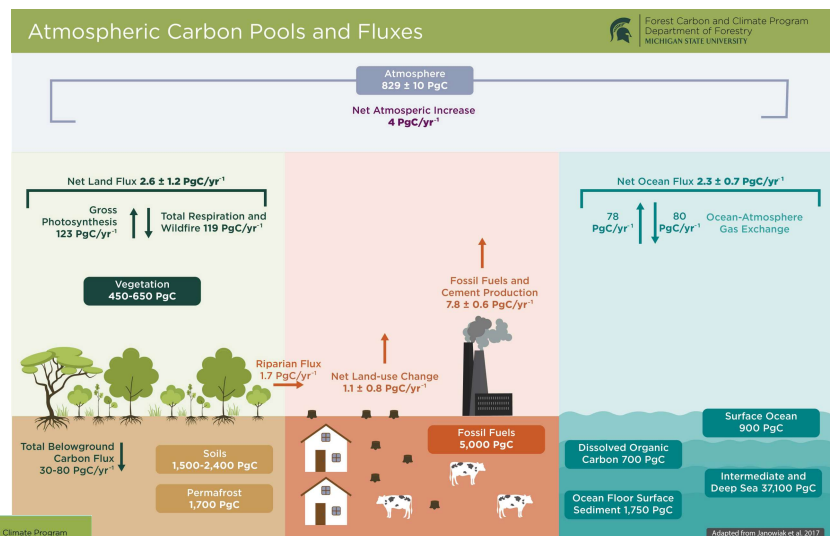
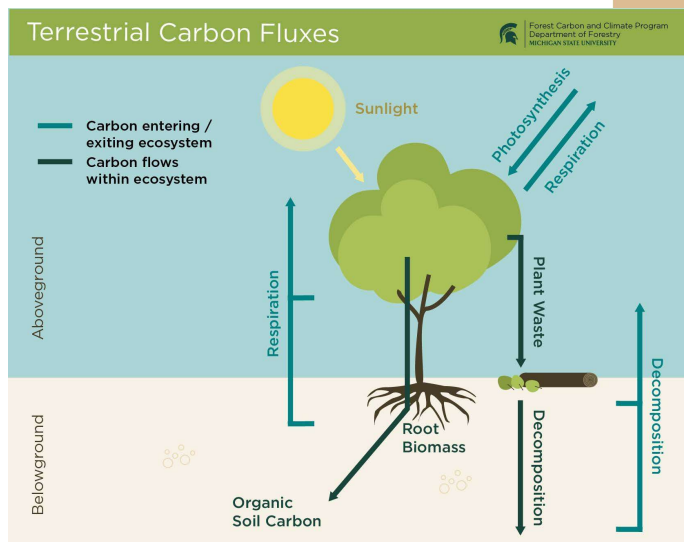


Image: Janowiak et al. 2017



Science Background: Carbon Cycle and Storage

Human Interaction with the Global Carbon Cycle

Sources of CO₂ emissions from human activities

1. Fossil Fuel Combustion

- Petroleum, natural gas and coal
- Transportation, heating, cooling, electricity generation, industrial activities, cement production

2. Land-use Change

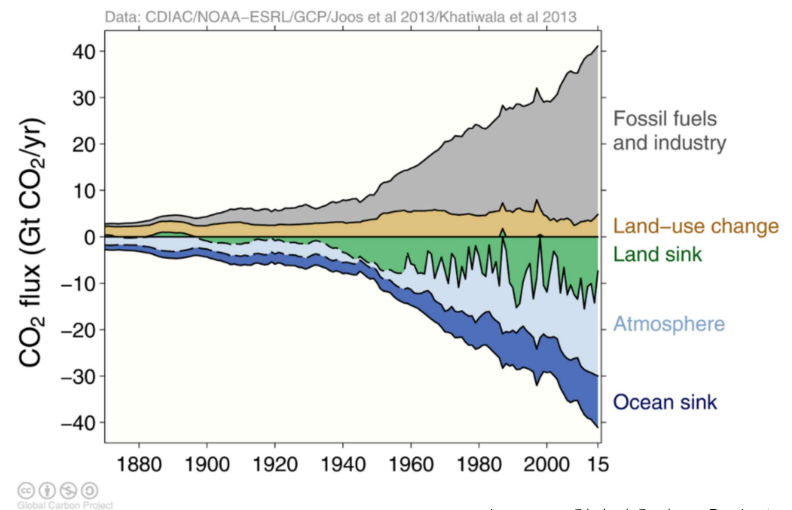
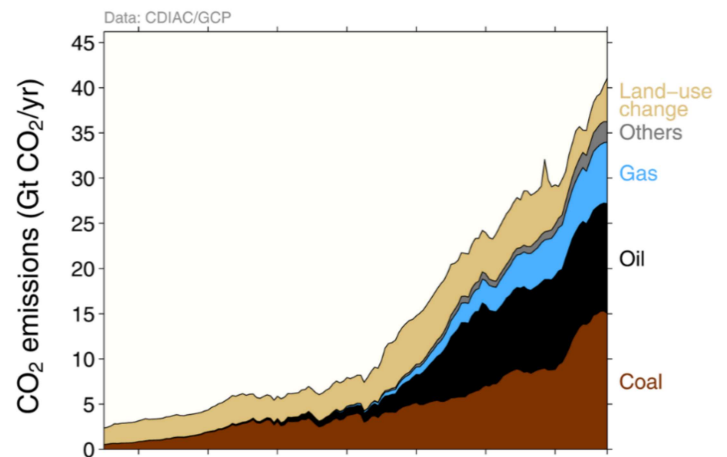
- Clearing of native ecosystems and conversion to agriculture or other land uses
- Tropical deforestation

100-year history of CO₂ emissions

- 1880 - 2000
 - Total CO₂ greatly increased
 - Land-use change emissions remain relatively constant
 - Made up 80% of all human emissions in 1880s
 - Today, 12% of total emissions due to rise in coal, oil, and gas

Terrestrial Sinks and Sources

- Sinks: absorb and store carbon, a negative counterbalance to carbon in the atmosphere
- Industrial revolution marks change in share of fossil fuels as a source
- Oceans, atmosphere, and land (i.e. forests) store a share of excess carbon released into atmosphere, which is why this graph is generally mirrors across zero line
- 2006 - 2015
 - **Sources:**
 - Fossil fuel combustion - 91%, 34.1 GtCO₂/yr
 - Land-use change - 9%, 3.5 GtCO₂/yr
 - **Sinks:**
 - Atmosphere - 44%, 16.4 GtCO₂/yr
 - Terrestrial ecosystems - 31%, 11.6 GtCO₂/yr
 - Oceans - 26%, 9.7 GtCO₂/yr



Images: Global Carbon Project