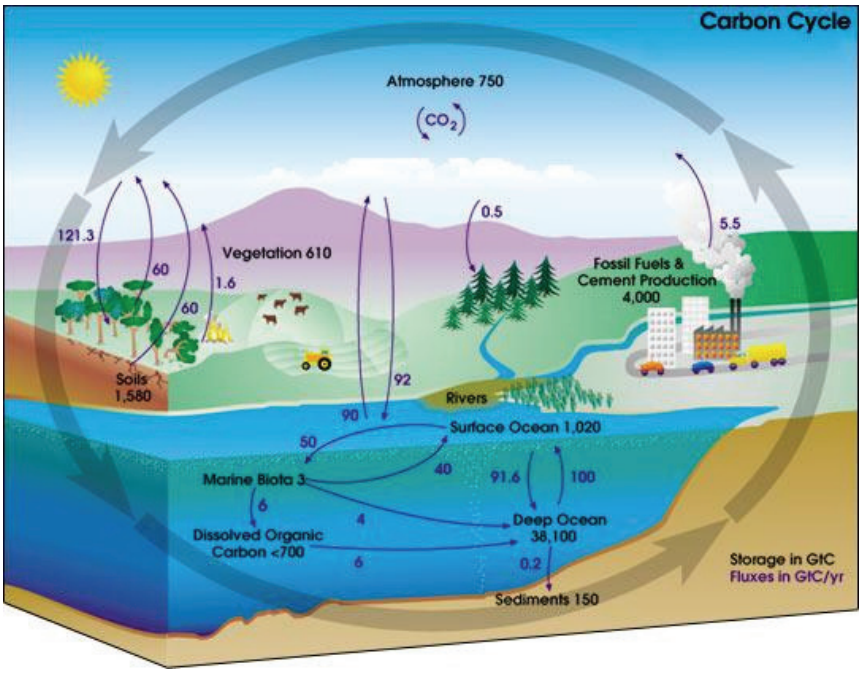
NIACS Fact Sheet

The Carbon Cycle

http://nrs.fs.fed.us/niacs/

Carbon is an abundant element that is necessary for life on Earth. The carbon cycle is the exchange of carbon between all of the earth's components—the atmosphere, oceans and rivers, rocks and sediments, and living things . The processes of *photosynthesis* and *respiration* are the basis of the carbon cycle. In photosynthesis, plants use energy from the sun and carbon dioxide (CO_2) gas from the atmosphere to create carbohydrates (sugars) and oxygen (O_2). Carbohydrates are then stored (or *sequestered*) in their *biomass* (living parts, such as leaves, stems, and roots) as plants live and grow. Stored carbohydrates can be used as energy. To use the energy, carbohydrates need to be broken down in respiration and CO_2 is released back into the atmosphere. The rate at which CO_2 is produced is variable. For example, decomposition— where fungi and microorganisms break down carbohydrates to gather energy— is a slow but significant way that carbon is returned to the atmosphere.



The carbon cycle is the exchange of carbon between all of the earth's components. Scientists can estimate the amount of carbon present within and moving between different systems. (Image courtesy of NASA.)

The carbon cycle involves the *flux*, or flow, of carbon between different earth systems. An object or process that absorbs and stores carbon is called a *sink*, while one that releases carbon faster than it is absorbed is termed a *source*. For example, a healthy plant is a carbon sink because it is taking in CO_2 from the air and storing it in new leaves and roots and a larger stem. However, a plant can become a source of carbon if the amount of CO_2 going out exceeds the amount taken in. This might happen if a plant is eaten and an animal utilizes its carbon for energy or if CO_2 is sent back into the atmosphere through decomposition or fire.

Humans have a large impact on the worldwide carbon cycle. Fossil fuels, including coal, oil, and natural gas, all contain large amounts of carbon that was formed during the decomposition of plants and animals over millions of years. Burning fossil fuels releases large amounts of CO_2 and other greenhouse gases into the atmosphere faster than natural processes. Changes in land use, especially deforestation, also contribute to elevated levels of atmospheric CO_2. Although plants absorb some of the additional CO_2, most of the greenhouse gases remain in the atmosphere and contribute to climate change.

Scientists throughout the world are working to quantify the amounts of carbon stored in different components of the earth and their interactions. Carbon can be measured using two different approaches. One approach is to use satellites and metrological instruments to measure the flux of CO_2 in the air. The other is to measure the amount of carbon present in samples from plants, trees, soil, and other components and scale those up to a regional or worldwide level. Using these methods scientists have been able to determine the approximate quantities and fluxes involved in the global carbon cycle (see figure above). However, the precise size of many sources and sinks is still unclear because of the complexity of the systems involved.

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