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Abstract: The article focuses on carbon cycle. Other than the flow of water, no mechanism in nature is more crucial than the circulation of carbon between air, land, and water. Only four forms of pure carbon are known - diamond, graphite, amorphous carbon, such as charcoal and soot, and fullerene. Yet carbon's ability to bond with most nonmetals has made it the basis of all organic compounds - plant and animal. Terrestrial vegetation uses 60 billion metric tons of carbon a year to grow - providing oxygen in the process.

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The carbon cycle

A DELICATE BALANCING ACT FOR LIFE'S VITAL ELEMENT

Other than the flow of water, no mechanism in nature is more crucial than the circulation of carbon between air, land, and water. Only four forms of pure carbon are known — diamond, graphite, amorphous carbon (such as charcoal and soot), and fullerene, the molecule at left. Yet carbon's ability to bond with most nonmetals has made it the basis of all organic compounds — plant and animal. Terrestrial vegetation uses 6O billion metric tons of carbon a year to grow — providing oxygen in the process. The demand would exhaust carbon in the atmosphere if not for constant replenishment through plant respiration and decomposition of organic matter. In its complex, finely calibrated gearing, the carbon cycle sustains life on Earth.

The greenhouse effect

Most life on Earth would perish from the cold without an atmosphere to trap heat. A balance of water vapor, CO[sub2], methane, and other gases reradiate enough of the sun's heat back to the surface (left), like panes of a greenhouse, to set the average global temperature at 57°F. This natural warming has been aggravated by a 30 percent increase in CO[sub2] concentrations since the industrial revolution. In the past century the global temperature has risen by one degree — the effects seen in intensifying storms and rising sea levels. Increased greenhouse gas levels, scientists fear, will keep temperatures rising and lead to more damaging climatic changes.

HUMAN MONKEY WRENCH

The smooth meshing of the carbon cycle's many parts depends on large quantities of carbon being withdrawn from the atmosophere and stored in forests, oceans, and underground deposits of coal, natural gas, and petroleum. Human have disrupted the cycle, releasing carbon prematurely from these reservoirs beginning with the burning of forests. The burning of fossil fuels has accelerated the release, flooding the atmosphere with enough carbon dioxide to affect global climate.

AN APPETITE FOR CARBON

Mapping vegetation on land and in the sea pinpoints the most active areas of carbon uptake during the not thern spring from March through May. Green regions indicate prolific photosynthesis. From nor them boreal woods and tropical rain forests to phytoplankton blooms in the nor them Atlantic Ocean, plants remove billions of tons of CO [sub2] from the air and water. The presence of carbon sinks is vital to moderating the human-made buildup of CO[sub2] in the atmosphere. A Arctic permafrost stores about 14% of the carbon found in the word's soils.

PRECIPITOUS RISE OF CO[sub2]

Major climate shifts of the past 420,000 years — an alternation of ice ages and interglancial periods — never triggered a spike in atmospheric carbon dioxide like the one recorded in the past 150 years. Analyzing air trapped in ice cores from Antarctica, scientists have graphed (right) how the once stable range of CO[sub2] concentrations ended with the modern era's unprecedented burning of fossil fuels. Atmospheric CO[sub2] is predicted to rise to two to three times preindustrial levels by 2100.

If nature withdraws its helping hand, we could be facing drastic changes even before 2050, a disaster too swift to avoid.

BURNING Combustion of fossil fuels and forests pours CO[sub2] back into the air.

STORING Vast amounts of carbon stay out of circulation for eons, locked up in crustal rock, ocean depths, and coal, oil, and natural gas.

EXCHANGING Carbon dioxide, soluble in water, passes continuously between air and sea. Carbon also cycles rapidly between marine plants and animals.

GROWING Plants remove CO[sub2] from the atmosphere through photosynthesis, using carbon as an energy source and to build tissue.

DECOMPOSING Respiration by bacteria and fungi that feed on organic matter returns CO [sub2] to the atmosphere.

WHAT PART IS CARBON?	
Diamond	100%
Graphite	100
Coal (anthracite)	92
Oil	86
Wood	50
PVC	38
Limestone	12%
Africultural soil	1-2
Steel	0.2-1.5
Air	.015
Scawater	.0025

Concrete	0
Quartz	0

GRAPH

DIAGRAM

MAP

PHOTO (COLOR): So where is the missing carbon? Oceans and forests are absorbing, at least for now, roughly half of the eight billion tons of carbon that humanity is pouring into the atmosphere each year. Even photosynthesizing bacteria living in a New Zealand thermal pool do their part absorbing CO[sub2] (above). The continued ability of sinks to absorb carbon may vanish If global warming persists. Higher water temperatures would reduce the ability of oceans to dissolve CO[sub2], limiting the carbon available to phytoplankton, the aquatic plants that begin the food chain for creatures ranging from whales to sea urchins (left). Increased odds of drought and fire threaten the health of terrestrial sinks like a cedar forest (right). With rising temperatures, decomposition would quicken, releasing carbon faster from a decaying cow in Brazil (below) and a moldering leaf in an Amazon stream (below right).

PHOTO (COLOR)